

FM 57-38

S/S by 9 April 1993 Reference

FM 57-38

Reference

DEPARTMENT OF THE ARMY FIELD MANUAL

Ch. 2

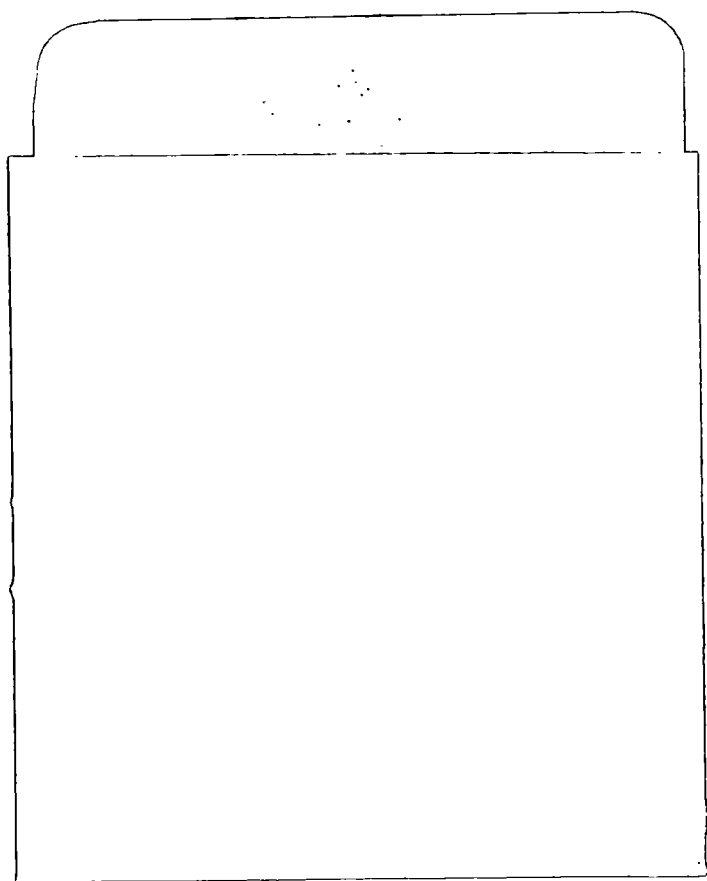
● PATHFINDER OPERATIONS

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HEADQUARTERS, DEPARTMENT OF THE ARMY
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No. 1

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*FM 57-38
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 2 July 1970

PATHFINDER OPERATIONS

FM 57-38, 9 October 1968, is changed as follows:

Page 3, paragraph 1f. Line 8 is changed to read: "plete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and for-".

Page 3, paragraph 2a. Lines 2 and 3 are changed to read: "units is to provide navigational assistance to, and control of, Army aircraft in areas designated".

Page 4, Paragraph 5d is added as follows:

"d. TOE 7-500G has been developed to replace the TOE for the pathfinder units indicated above less that of the airmobile division. The TOE is based on a cellular organization of from three to seven 6-man pathfinder squads to correspond to the three to seven lift companies attached to an aviation battalion, and can vary from a basic strength of 22 to a maximum strength of 49 personnel."

Page 5, paragraph 6d. In line 4, "avialable" is changed to read "available".

Page 5, paragraph 7d. In line 8, "outlined" is changed to read "outlined".

Page 10, paragraph 21b(2)(a). In line 28, "visal" is changed to read "visual".

Page 14, paragraph 24c(4). In line 4, "and" is changed to read "any".

Page 17, paragraph 25c(2). In line 3, "(CC(s))" is changed to read "CC(s)".

Page 21, paragraph 29b. In line 12, "obstalces" is changed to read "obstacles".

Page 21, paragraph 29b(3)(b). In line 15, "obstalces" is changed to read "obstacles".

Page 27, paragraph 30a. In line 11, "a" is changed to read "at".

Page 28, paragraph 30b. Under examples of radio messages, *Speaker*, line 3 is changed to read: "Flight leader-----Confirmation-----" * HAWK ONE, ROGER, OUT."

Page 29, paragraph 30d. In line 4, "arm-and-hand" is changed to read "hand-and-arm".

Page 30, paragraph 32b. In line 11, "landings" is changed to read "landing strips".

Page 34, paragraph 35a(3). In line 6, "depar-tues" is changed to read "departures".

Page 34, paragraph 35c(1). In line 5, "taxi" is changed to read "taxiing".

Page 34, paragraph 36a. In line 7, "visibil-ity" is changed to read "observation".

Page 35, paragraph 37a(2). In line 3, "ad" is changed to read "and".

Page 37, paragraph 37d(4). In line 3, "te" is changed to read "the".

Page 37, paragraph 37e. In line 5, "aircrat" is changed to read "aircraft".

Page 37, paragraph 37e. Titles specifying parts of radio messages are changed to read: "*Speaker, Topic, Message*".

Page 43, paragraph 44b(1). In lines 20 and 21, "(OR STEER HARD) RIGHT (LEFT)." is changed to read "OR STEER HARD RIGHT (LEFT)."

Page 46, appendix A. After line 34 the following is added: "TM 5-725, Rigging."

Page 47, appendix A. In line 10, "TM 57-220 Technical Training of Parachutist." is changed to read "TM 57-220, Technical Training of Parachutists."

Page 47, appendix A. In line 9, "TM 57-210,

* This change supersedes TC 21-4, 6 September 1968.

Page 23. Figure 6 is superseded as follows:

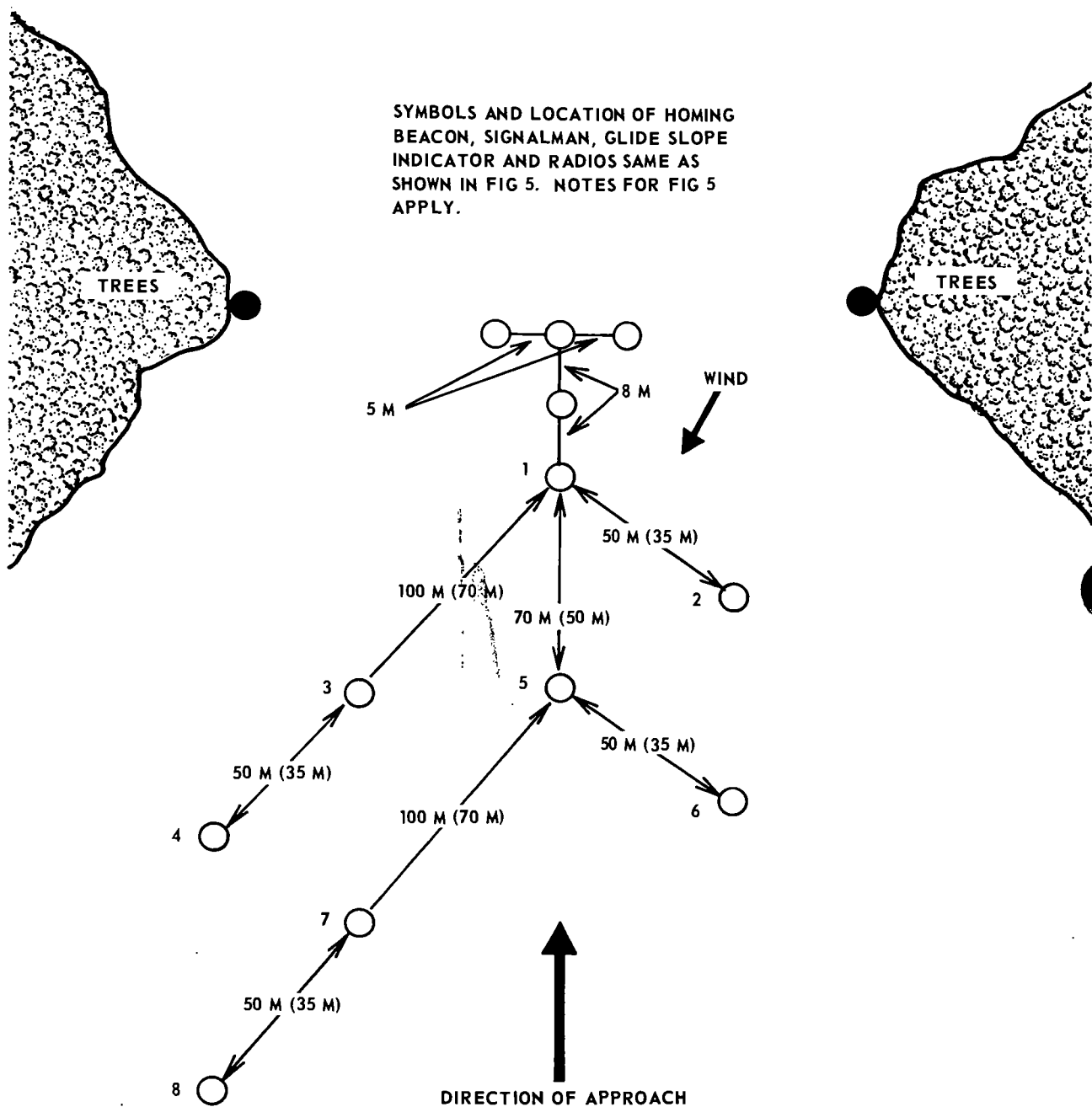


Figure 6. Night UH-1 landing site, flights heavy left formation.

Page 25. Figure 8 is superseded as follows:

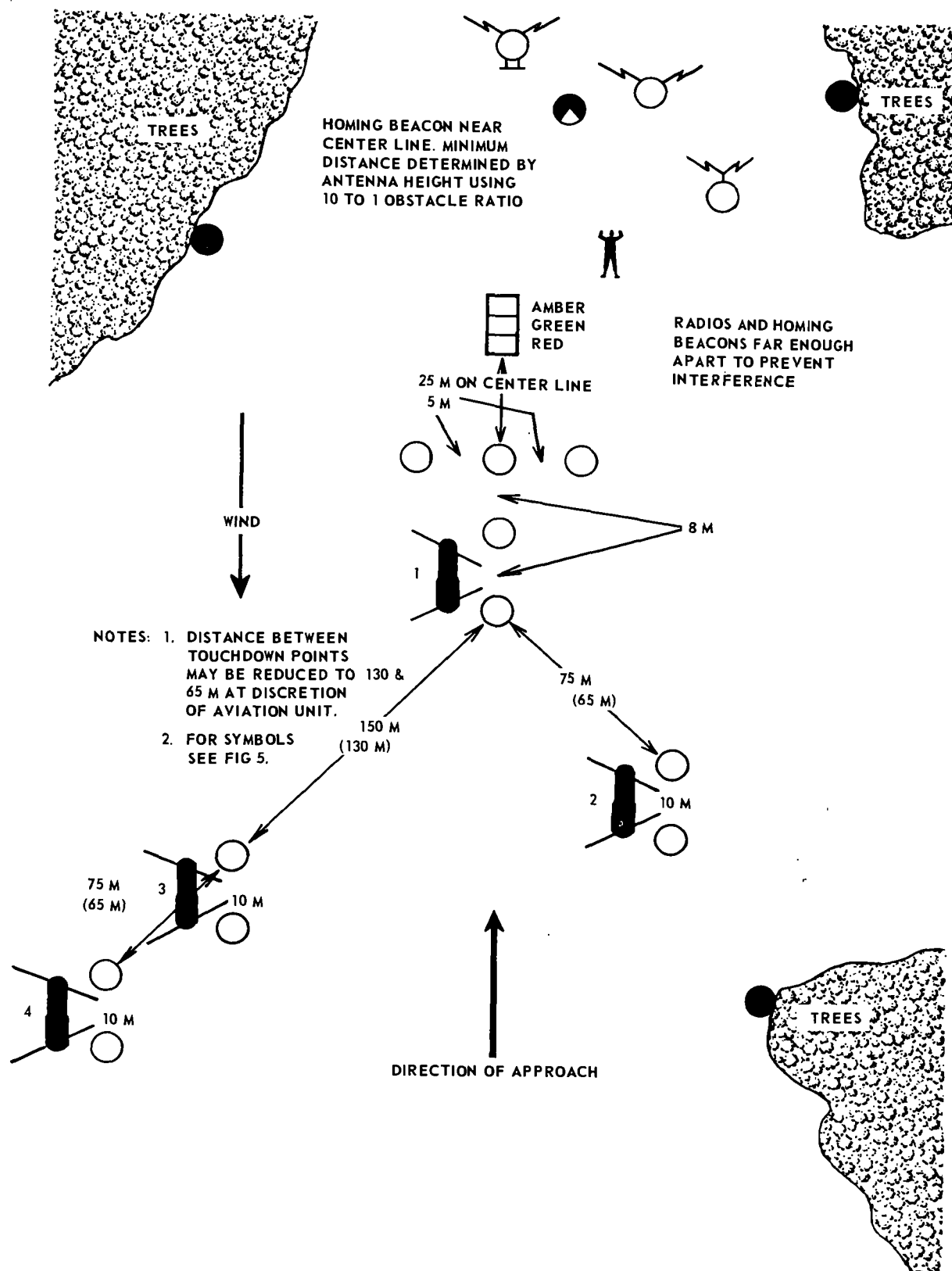


Figure 8. Night CH-47 landing site, flights heavy left formation.

Page 26. Figure 9 is superseded as follows:

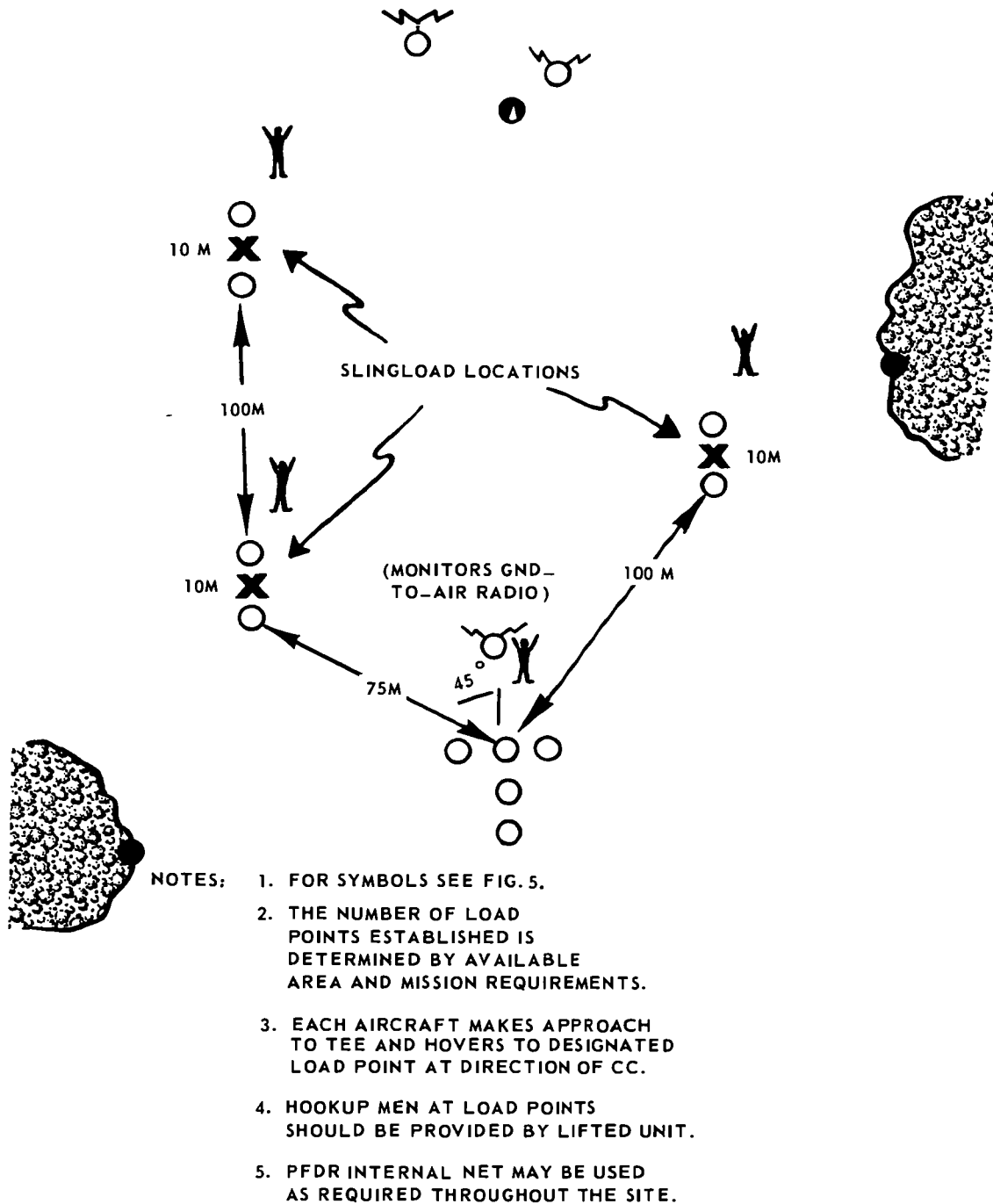


Figure 9. Night CH-47 sling load pickup and/or drop site.

Air Movement of Troops and Equipment." is changed to read "TM 55-450-15, Air Movement of Troops and Equipment (Administrative)."

Page 53. Figure 16 is superseded as follows:

Page 56, paragraph 3e. In line 4, "270°" is changed to read "TWO SEVEN ZERO DEGREES".

Page 56, paragraph 4a. Line 3 is changed to read: "Example. MUDDY 750, CLEARED FOR IMMEDIATE".

Page 56, paragraph 4b. Line 3 is changed to read: "Example. MUDDY 750, TAKEOFF IMMEDIATELY."

Page 56, paragraph 4p(1). Line 2 is changed to read: "Example. MUDDY 750, BE ADVISED ARMY HELICOPTER ON".

Page 57, paragraph 4p(2) is changed to read: "(2) To pilots familiar with military designations".

Page 59, paragraph 7. In line 1, "controlled" is changed to read "controller".

Page 66, figure 27 caption, line 1, "Cut sling load. Left arm is extended" is changed to read "Move left. Right arm extended horizontally".

Page 71. Appendixes G, H, and I are added as follows:

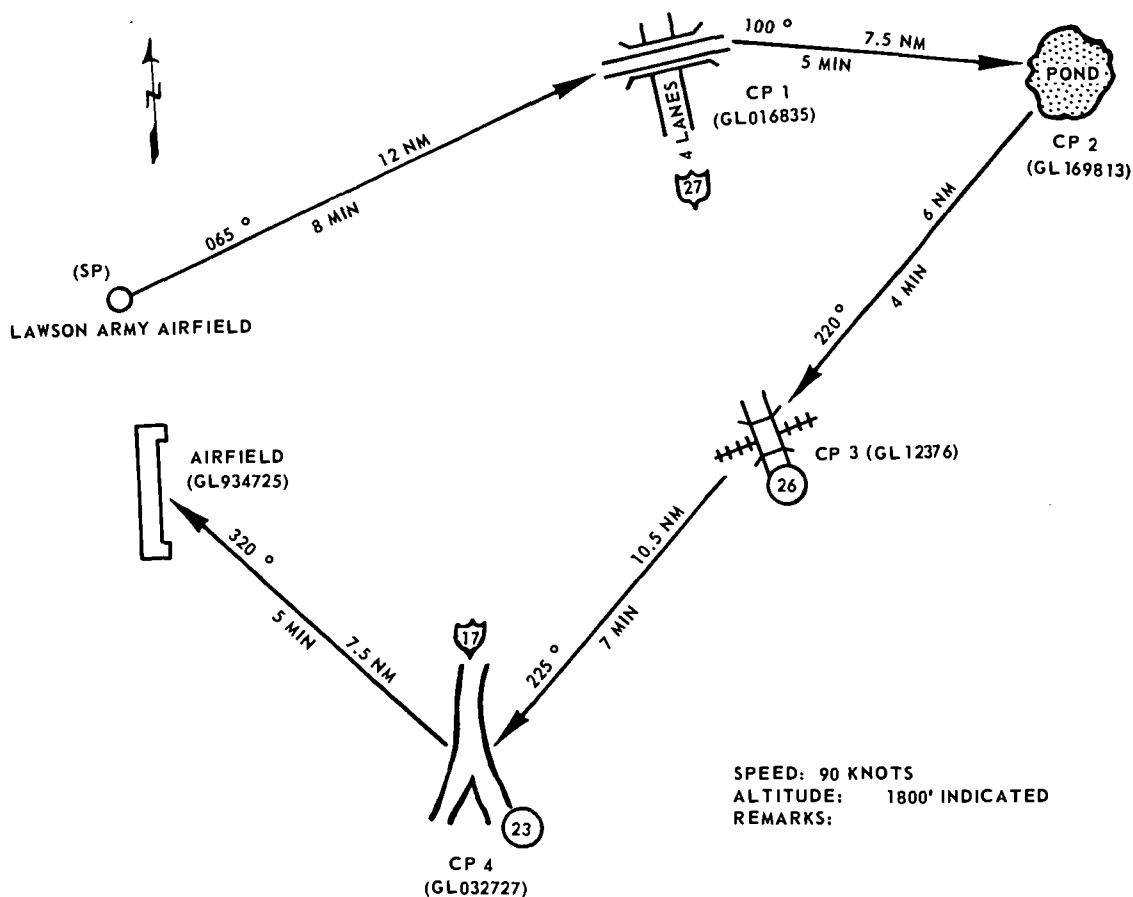


Figure 16. Sample aerial navigation strip map.

APPENDIX G (ADDED)

RAPPELLING FROM HELICOPTERS

Section I. INTRODUCTION

1. General

a. The material contained in this appendix illustrates the techniques, procedures, and equipment required for developing and maintaining proficiency in rappelling from the *UH-1 series helicopters* (fig 38).

b. This appendix also contains material pertaining to training apparatus, maintenance and safety procedures, qualification requirements, and a recommended training course.

2. Qualification Requirements

Individuals will be considered rappel qualified when the following requirements are met:

a. The individual must exhibit satisfactory performance from a 35-foot rappelling tower (fig 39) prior to progressing to rappels from a hovering helicopter. In order to do this, he must—

(1) Complete a minimum of three satisfactory rappels from the tower, to include a minimum of one rappel with combat equipment and rifle.

(2) Demonstrate confidence in rappelling techniques.

(3) Know the procedures, techniques, and

equipment necessary to rappel from a helicopter.

b. During the helicopter phase of training, the individual must—

(1) Complete two rappels satisfactorily from a helicopter from a height of approximately 60 feet.

(a) The first rappel will be without combat equipment.

(b) The second (and any succeeding rappels) will be with combat equipment to include a rifle.

(2) Demonstrate confidence and proficiency in the techniques, procedures, and equipment utilized in rappelling from a helicopter.

c. In order to maintain proficiency, individuals should conduct rappels with combat equipment a minimum of once monthly from the 35-foot rappelling tower and a minimum of once quarterly from a helicopter. A record of each individual's proficiency training should be maintained by the unit.

d. Any individual who has not performed a rappel from a helicopter for a period in excess of 3 months must perform three satisfactory rappels from the tower, to include one with combat equipment. This will serve as a refresher and must be accomplished prior to executing rappels from a helicopter.

3. Recommended Training Course for Aircraft Rappelling

Period	Subject	Scope	Hours
1	Introduction and orientation.	Techniques used in helicopter rappelling; safety procedures; equipment needed for such an operation.	1
2	Ropes and knots	Terminology, characteristics and maintenance of the rappelling ropes. Proper coiling, tying off of coils, method of carrying. Types of knots utilized in rappelling with emphasis on anchor knots and preparation of swiss seat.	1
3	Tower training	Explanation of procedures used in rappelling from tower; safety procedures on tower; demonstration and practical exercise in rappelling from tower.	3

3. Recommended Training Course for Aircraft Rappelling—Continued

Period	Subject	Scope	Hours
4	Helicopter training	Explanation of procedures used in rappelling from helicopters; rigging and padding of helicopter; safety check and safety procedures; demonstration and practical exercise in rappelling from helicopters.	3
Total hours:			8

4. Individual Training Records

A training card should be maintained on each rappeller assigned to the unit to record rappel

qualifications and training status. Entries should be made upon completion of training and should include the number and types of rappels performed.



Figure 38. The UH-1D and rappellers.

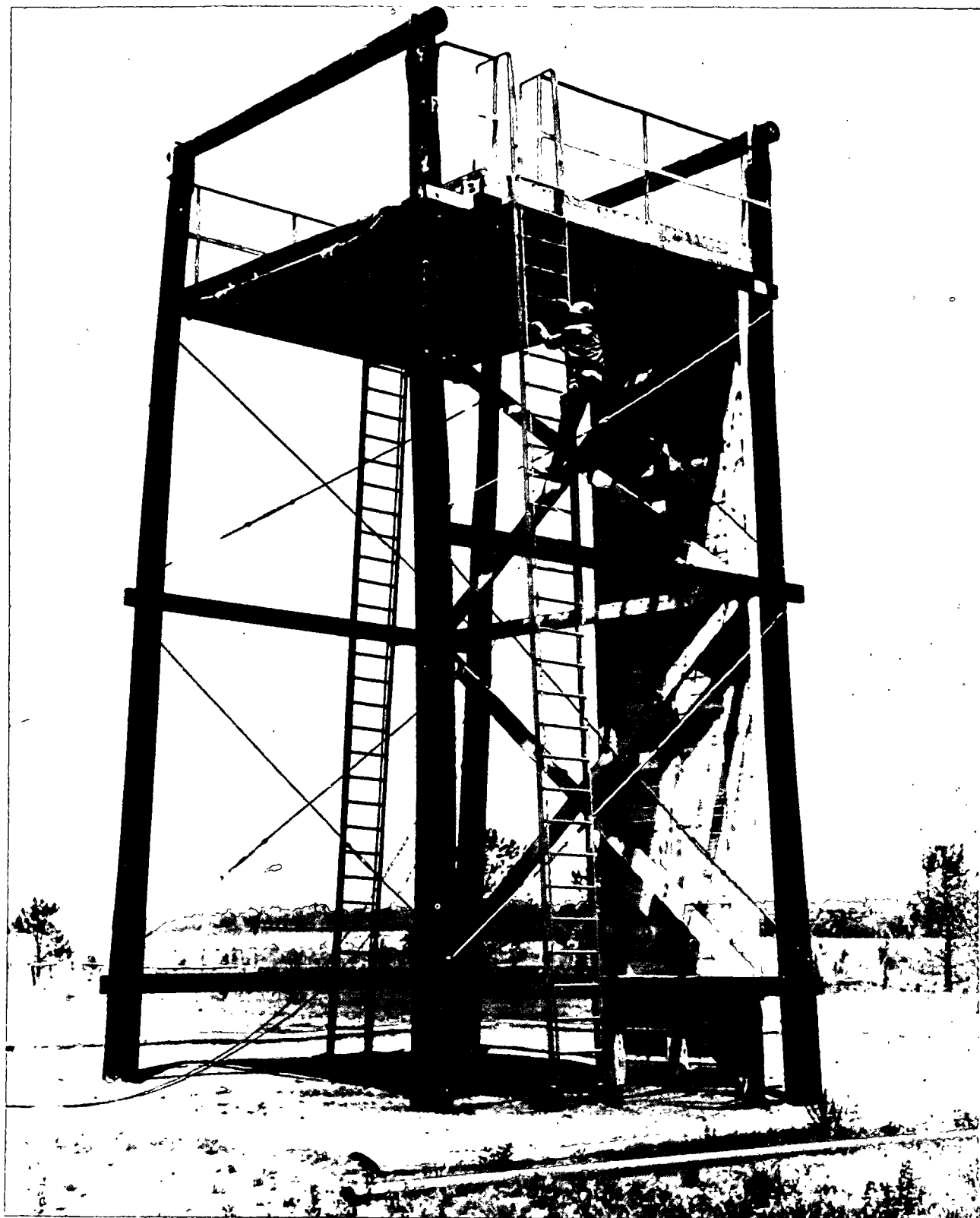


Figure 39. Rappelling tower.

Section II. ROPES AND EQUIPMENT

5. General

This section describes the equipment necessary to execute a successful rappel from a helicopter. With a few special exceptions, the ropes, equipment, and preparatory training techniques used for helicopter rappelling are identical to those used for mountain rappelling (FM 31-72). It is essential that the individual have a thorough knowledge of the equipment to be used—description, characteristics, and care and maintenance procedures, if the techniques being taught are to be properly employed in either a training or combat environment.

6. Terms Used in Rappelling Operations

a. Ropes. Ropes (often called lines) include the 120-foot nylon climbing rope, and the 12-foot nylon sling rope.

b. Running End. The running end is the free end or working end of a rope.

c. Standing Part. The standing part is the balance of the rope excluding the running end.

d. Bight. A bight is a bend or U-shaped curve in a rope.

e. Loop. A loop is a fold or doubling of a rope through which another rope can be passed. A temporary loop is made by a knot or hitch. A permanent loop is made by a splice or some other permanent means.

f. Turn. A turn is the same as a loop, but usually describes the placing of a rope around a specific object such as a post, rail, or ring, so that the running end continues in a direction opposite to the standing part.

g. Round Turn. A round turn is the same as a turn, with the running end leaving the circle in the same general direction as the standing part.

h. Knot. A knot is any tie or fastening formed with a cord, rope, or line, including hitches.

i. Hitch. A hitch is used to tie a rope around an object so that it will hold temporarily but can be readily undone.

j. Whipping. A whipping is a binding of light cord or tape on the end of a rope to prevent it from unraveling.

K. Reference. TM 5-725.

7. Nylon Climbing Rope

The nylon climbing rope is an item of issue which can be obtained through normal supply channels. It is the standard rope for rappelling. The description and characteristics of this rope are as follows:

a. Description.

- (1) Nylon (FSN 4020-231-2537).
- (2) Issued in coil 120 feet in length.
- (3) Seven-sixteenths of an inch in diameter.
- (4) Three-strand, multi-filament, twisted rope with a right-hand lay.

b. Characteristics.

- (1) Tensile strength of 3,840 pounds when dry and 18 percent less when wet.
- (2) Stretch factor of one-third of its length due to the elasticity of the nylon.

8. The Sling Rope

The sling rope possesses the same characteristics as the nylon rope. It is 12 feet in length and is whipped on both ends.

9. Care and Maintenance

Because the rope is the rappeller's lifeline, it requires and deserves a great amount of care.

a. Rope Inspection.

(1) Before and after using a rope, it should be carefully inspected for excessive wear and frayed, cut, mildewed, or rotten spots. If such spots are found but the rope is deemed usable for sling rope, it should be whipped on both sides of the bad spot and then cut. The rope should never be spliced since splicing greatly reduces the tensile strength of the rope.

(2) Any rope that has defective areas that

might conceivably result in an accident must be separated from usable rope and turned in through supply channels. Such ropes should be tagged, identifying the defect. If the defect is of an unusual nature, the possible cause, date, and name of the inspector will be reported.

(3) Normal reporting procedures for defective ropes will be used if the rope has a manufacturing defect.

b. Care of the Rope.

(1) The rope should not be stepped on or dragged on the ground since small particles of dirt will be ground between the strands and gradually cut them.

(2) The rope should not be used where it will come in contact with sharp edges or corners of equipment, apparatus, or rocks. This will tend to cut or fray the rope. If it is necessary for a rope to come in contact with such areas, pad or tape the surfaces to prevent damage to the rope.

(3) Keep the rope as dry as possible. If it has become wet, dry it as soon as possible to prevent rotting. Avoid excessive heat in drying. Do not store the rope when it is wet or damp.

(4) Do not leave the rope tightly knotted or stretched any longer than necessary. Knots weaken a rope as does stretching under tension for extended periods of time.

(5) Do not hang ropes from sharp edges such as nails.

(6) When using ropes in rappelling operations, do not let one rope rub against another, since this may cut or burn the ropes. When ropes are installed wet, the tension should be relieved periodically, since ropes tend to contract when wet, and unless relieved of tension, they may be damaged.

(7) Ropes weaken with age, weathering, and rough treatment.

(8) Gasoline, oils, and acids are corrosive and deteriorate ropes. If a rope becomes saturated with any of these substances, it should be removed from use.

10. Coiling the Rope

The rope should always be coiled when not in actual use. New ropes should be marked in the

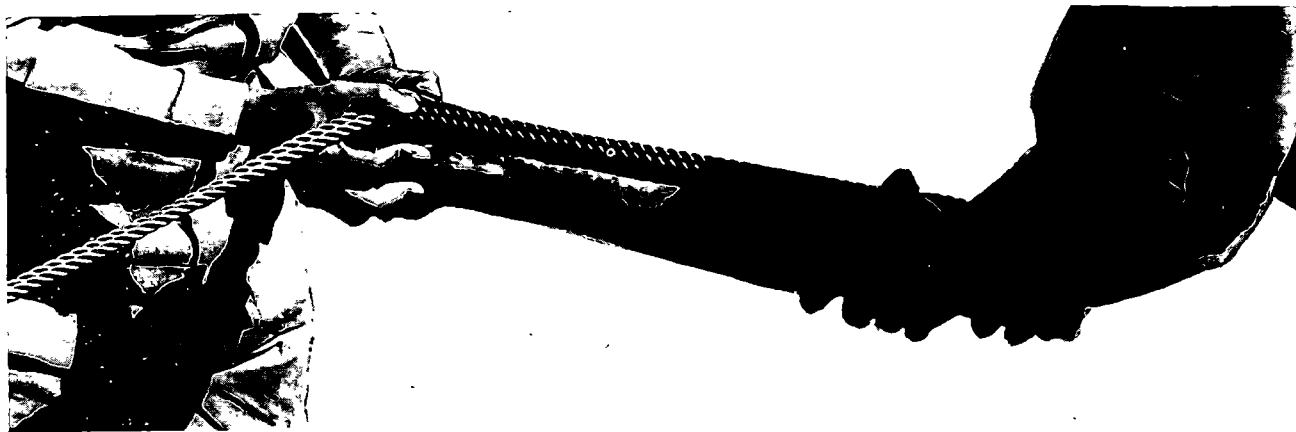
middle by tying a small piece of string around one of the strands. Two methods of coiling ropes are as follows:

a. Arm Coil. One end of the rope is taken in the left hand; the right hand is run along the rope until both arms are outstretched. The hands are then brought together, forming a loop which is laid in the left hand. This procedure is repeated, forming uniform loops until the entire rope is coiled. If there is any tendency for the rope to twist or form figure eights, it may be given a slight twist with the right hand to overcome this. The rope should always be coiled in a clockwise direction. When tying the coil, a 10-inch bight is made in the standing end of the rope and laid along the top of the coil. Uncoil the last loop of the coiled rope, take the length of the rope thus formed, and wrap it around the coil and the bight. The first wrap is made at the open end of the bight in such a manner as to lock itself. Continue wrapping toward the closed end until just enough rope remains to insert through the bight. Pull the running end of the bight to secure the wrapped rope. A rope properly coiled has from six to eight wraps. The coil can then be carried either on the ruck-sack by forming a figure eight and doubling it, placing the coil under the flap of the rucksack, or by placing it over one shoulder and under the opposite arm.

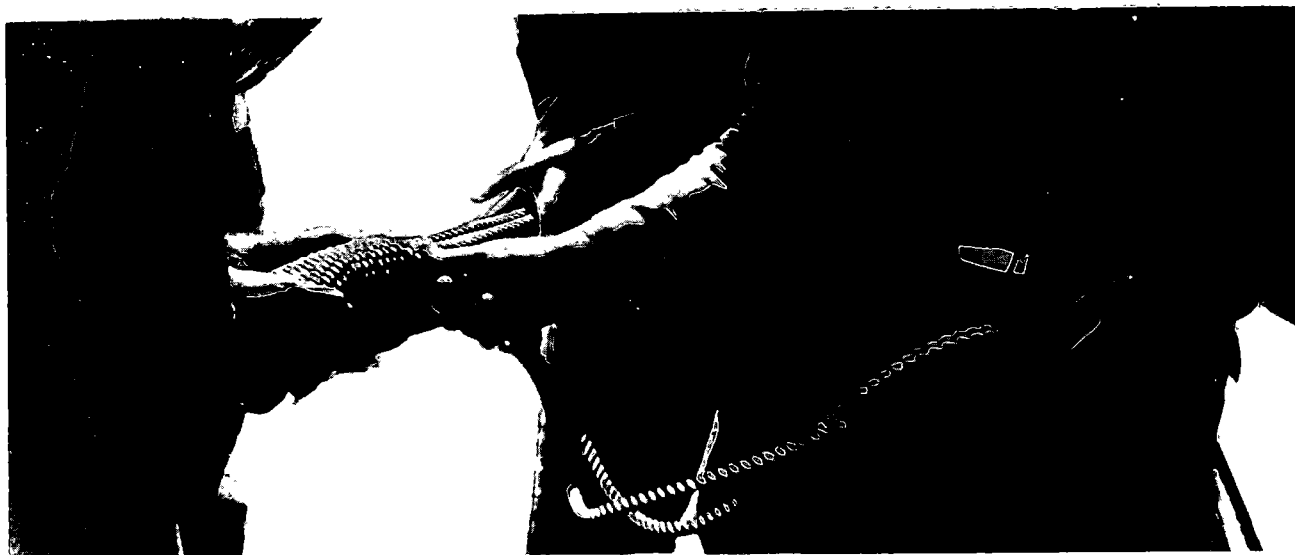
b. The Log Coil. The running end of the double rope is laid along the length of the coiling log as shown in ①, figure 40. The double rope is then coiled around both the running end of the rope and the coiling log as depicted in ②, figure 40. Care must be taken to insure that the rope is coiled evenly and tightly.

11. Knots Used in Rappelling

a. Half Hitch. The half hitch is used to tie a rope to a timber or to another larger rope. This is not a secure knot or hitch, and it is used for temporarily securing the free end of a rope. To tie the half hitch, pass the rope around the object to be secured, bring the running end around the standing part, and back under itself.



1



2

Figure 40. The coiling log.

b. *Square Knot.* The square-knot is used to tie the ends of two ropes of equal diameter together and must be secured by a half hitch on either side of the knot. To tie the square knot, lay the running ends of the ropes together but pointing in opposite directions. Pass the running end of the rope under the standing part of the other rope. Bring the two running ends up away from the point where they cross again. Pass one running end under the other so that each running end is parallel to its own standing part and pull tight (①, fig 41).

c. *Anchor Knot.* An anchor knot is used to tie the end of a rope to any object, and is easy to tie and untie. Care must be taken in selecting an anchor knot that will not work itself loose when alternating tension and slack are applied. Two types of anchor knots that may be used are as follows:

(1) *Round turn with two half hitches.* This knot is best used when constant tension is applied to the running end of the rope. To tie this knot, pass the running end of the rope through a ring (or around the anchor object) in two complete turns. Bring the running end around the standing part and back under itself to make a half hitch. Make a second half hitch. For greater security, the running end of the rope should be secured to the standing part. Tape may be used for securing (②, fig 41).

Note. The round turn with two half hitches is the preferred method used in securing the rappel rope to snaplinks used with the anchor system shown in figures 46-49.

(2) *Bowline.* The bowline is used to best advantage when alternating tension and slack are applied to the rope. It will not tighten under strain and will untie easily. To tie the

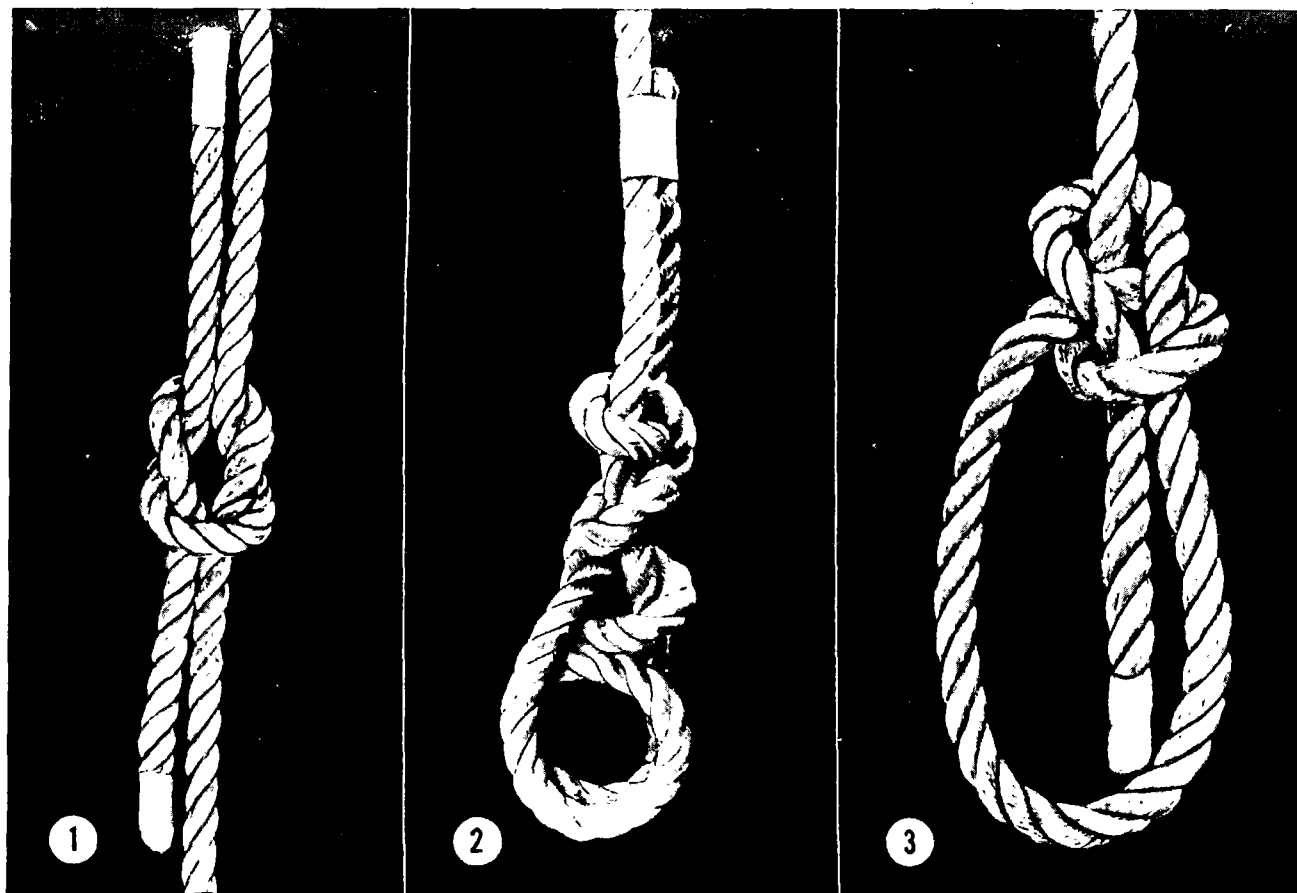


Figure 41. Knots used in rappelling.

bowline, pass the running end of the rope through the ring (or object to which it is to be attached) and make a loop in the standing part of the rope. Next, pass the running end of the rope through the loop from underneath, up and around the standing part of the rope, and back through the loop from the top down. The running end passes down through the loop parallel to the line coming up through the loop. Pull the knot tight (③, fig 41).

Note. The bowline may be used in lieu of the round turn with two half hitches as an alternate method for securing the rappel rope to snaplinks used with the anchor systems shown in figures 46-49.

d. References. FM 31-72, TM 5-725.

12. Individual Equipment and Component Parts

The following equipment is necessary for the conduct of rappelling operations:

a. Snaplink. This is an item of issue obtained through normal unit supply channels. The snaplink (FSN 8465-360-0228) possesses a 2,000-pound capacity with the gate closed. The gate must be checked for safety, spring pressure, proper locking, and correct placement to prevent accidental opening. The snaplink is used to connect the rappel seat to the rappelling rope.

b. Gloves. Rappelling gloves are mandatory for all phases of rappelling. The preferred gloves are heavy duty engineer work gloves (FSN 8415-268-7868), an organizational issue item.

c. Rope Coiling Log. This is a round, smooth-surfaced wood log from 2 to 3 inches in diameter and 16 to 24 inches in length. The rope will be coiled tightly around the log to prevent fouling when it is dropped from the rappelling tower or helicopter (figs 40 and 42).

d. Rappel Seat. The rappel seat is formed from a 12-foot sling rope and utilizes one snaplink. It is unique in that the main friction of a rappel is absorbed by the snaplink. The snaplink is inserted into the front of the rappel seat.

(1) *Construction and attachment of the rappel seat.* The sling rope is placed across the small of the back so that the midpoint (center) of its length is on the hip opposite to the hand that will be used in braking. An overhand knot is tied in front of the body. The ends of the rope are brought between the legs (front to rear), around the legs, and up through the rope tied around the waist. The ends of the rope are tied with a square knot and two half hitches on the side opposite the braking hand (fig 43).

(2) *Placement of the snaplink.* The snaplink is placed through the single rope around the waist and through the two ropes forming the overhead knot. The snaplink is inserted with the gate down and opening toward the body. The snaplink is then rotated one-half turn so that the gate is up and will open away from the body (fig 43).

e. Rappel Harness. This is a specially constructed piece of equipment which can be fabricated at unit level to facilitate training. It consists of a seat-type harness constructed of 1½-inch nylon webbing, forming two leg loops and a waistband fitted with a quick-fit snap fastener secured to a 3-inch steel ring. A 5-inch nylon strap, with V-ring, is attached to the 3-inch steel ring (see foreground fig 42). This harness is a component part of the lowering device, personnel, cargo, utility, 500 pounds (FSN 1670-999-0758).

f. Rappel Ring. This is a solid ring of cold rolled steel (para 13b(1)) with a tensile strength of 3000 pounds (above rappel harness in fig 42).

13. Special Equipment

Additional special equipment used during rappelling operations includes the following:

a. Donut Ring. The primary or No. 1 anchor point for the rappelling ropes (donut ring) will be constructed from ½-inch steel wire cable with a steel wire core (FSN 40-10-284-420). It will be 120 inches long, consisting of six strands, 18 wires to a strand, and have a minimum of 21,000 pounds tensile strength. The completed donut ring will possess a tensile

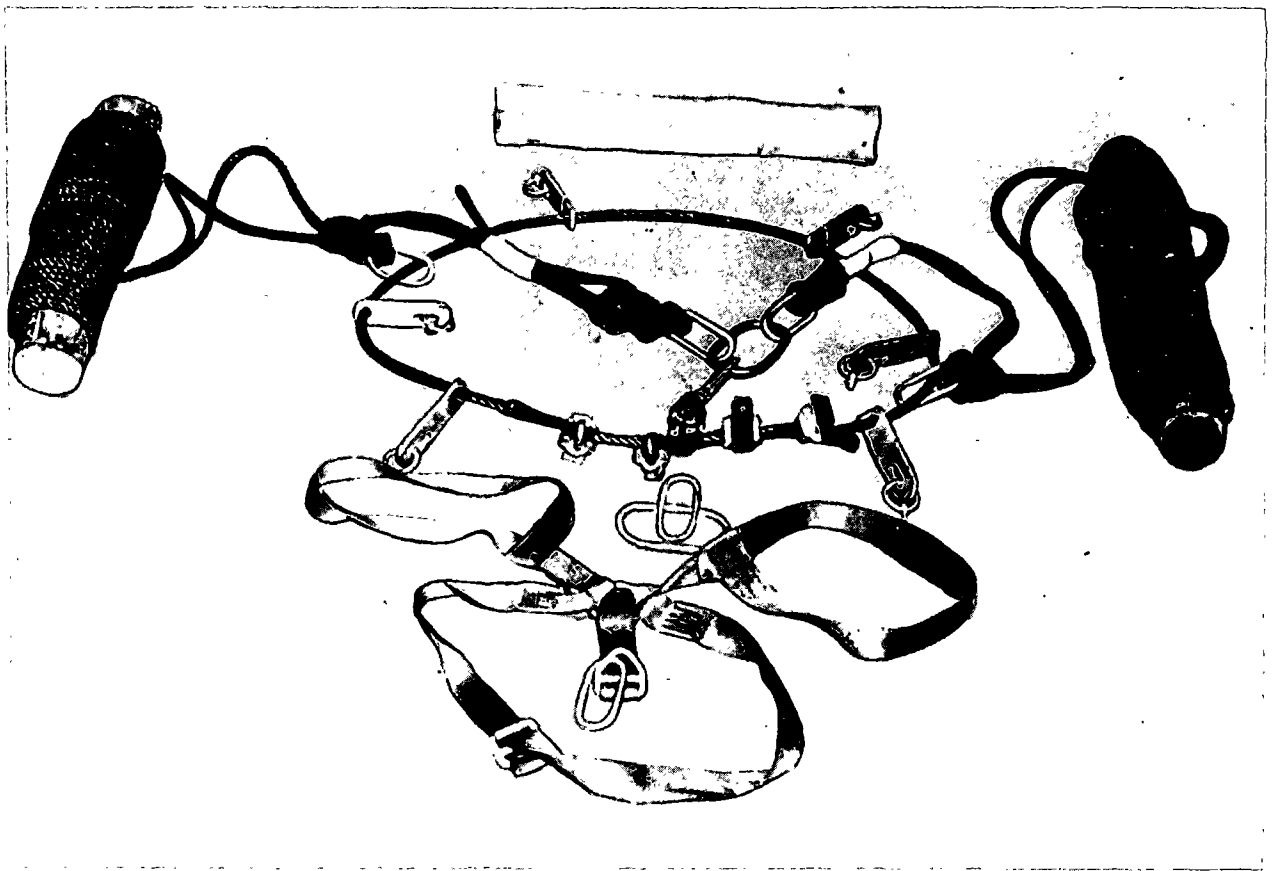


Figure 42. Rappelling equipment.

strength of 3,000 pounds. The donut ring will be constructed as follows:

(1) Thread six parachute static line snaphooks (FSN 5340-491-1065) onto the 120-inch steel cable so that four are facing with the gates out and down, and the center two snaphooks are facing in with the gates down (fig 44). The snaphooks must first be drilled to a $\frac{5}{8}$ -inch diameter on the inside of the end hole so that the cable will easily pass through.

(2) The ends of the 120-inch steel cable are overlapped 20 inches forming a circle and secured with four $\frac{1}{2}$ -inch U-bolts (FSN 1670-090-5354) placed at 2- to 3-inch intervals (fig 44). Two U-bolts are attached to each dead end of the steel cable so that the bolts first engage the dead end cable.

(3) Before torquing the U-bolts, position a 12-inch length of chain or $\frac{1}{8}$ -inch diameter

cable (FSN 40-10-171-4235) on the center of the overlapped 120-inch steel cable so that it will remain in position between the two center U-bolts.

(4) Each nut of each U-bolt will be tightened with a wrench (if possible, with a torque wrench to 40 foot pounds—480 inch pounds).

(5) After the U-bolt clamps have been attached and tightened, a steel plate drilled to fit will be fastened over the open end of the U-bolt studs and spot welded in place to prevent loosening.

b. Floating Safety Ring. This is referred to as the secondary or No. 2 anchor point for the rappelling ropes. The snaplink at the end of the rappelling rope is hooked to this connection. Either of the following two types of floating safety rings may be used:

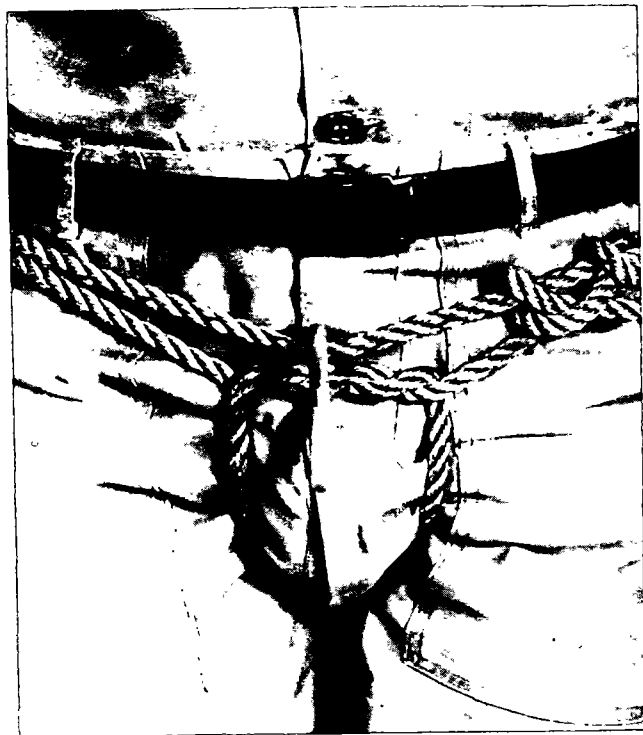


Figure 43. Rappell seat with snaplink.

(1) An elliptical rappelling ring, constructed of cold rolled steel $\frac{1}{4}$ inch in diameter, with inside dimensions of the ring being $2\frac{1}{4}$ inches (minor axis) and 4 inches (major axis), will be threaded through the free end of the keeper chain (cable). A seventh parachute static line snaphook will be threaded onto the ring prior to welding. The ring will be welded together so that it will withstand a pull of 3,000 pounds (fig 44).

(2) Two snaplinks will be attached to the aircraft tie-down ring in the center of the donut ring. These snaplinks will be attached in the following manner (fig 45):

(a) The first snaplink will be inserted through the free end of the keeper chain (cable) and the tie-down ring with the gate down (①, fig 45).

(b) The second snaplink will be inserted through the free end of the keeper chain (cable) and the tie-down ring with the gate up (②, fig 45).

(c) The snaplink gates are taped closed with masking tape.

(d) The snaplinks are then taped together, insuring that the snaplink gates are on opposite sides of each other (③, fig 45).

14. Rappel Rope Anchor Points

The rappelling rope is connected to the floating safety ring and the donut ring in the following order, and in the manner described (fig 46-49):

a. *No. 1 Anchor Point (Donut Ring)*. The No. 1 snaplink will be attached in the following manner:

(1) Take a bight approximately 5 feet from the end of the standing part of the rope.

(2) Insert the rope into the snaplink.

(3) Make one turn through the snaplink forming a round turn.

(4) Secure the round turn to the snaplink with two half hitches.

(5) Make the connection to the donut ring by snapping the snaplink up, fastening it to the cable. The gate will remain facing upwards, with the opening facing away from the knot.

b. *No. 2 Anchor Point (Floating Ring)*. The No. 2 snaplink will be attached in the same manner as the first with the following exceptions:

(1) Take a bight approximately 2 feet from the end of the standing part of the rope.

(2) Connect the snaplink to the rope in the same manner as the first connection. Tape the end of the standing part of the rope and the knots with masking tape or green engineer tape to secure them in place.

(3) The connection to the floating safety ring will be made in the same manner as the connection to the donut ring.

15. Rope Logbook and Record System

A record or logbook should be kept on each rappelling rope. Entries are made as necessary. The number and type of rappels should be recorded for each rappelling rope. A numbering or color-coding system should be used to aid in keeping an accurate record or log.

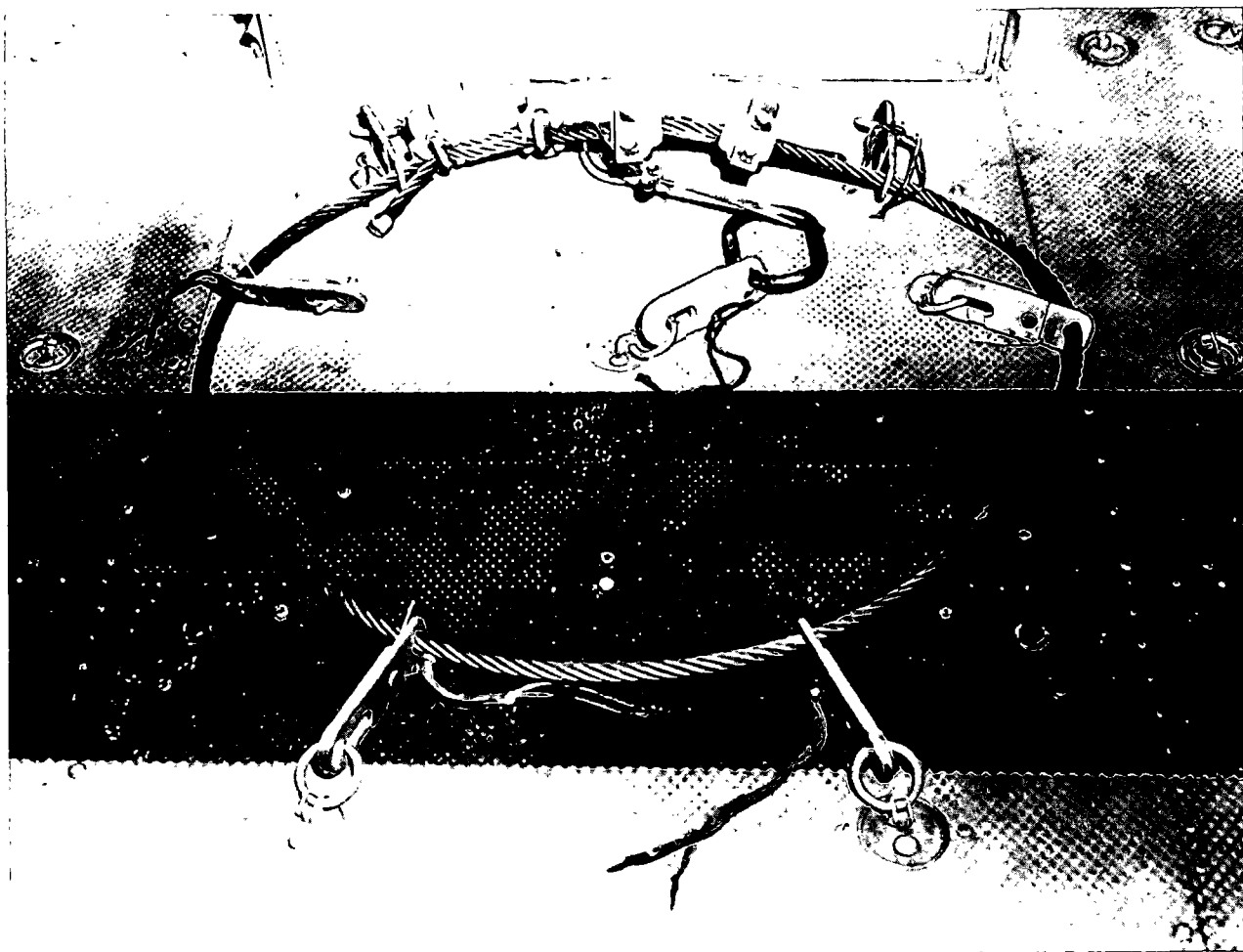
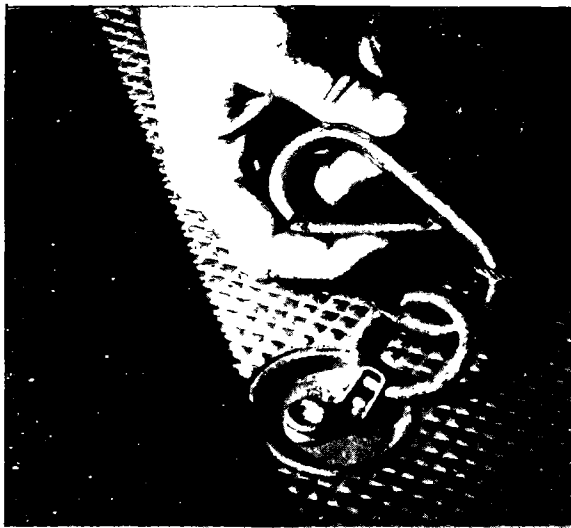
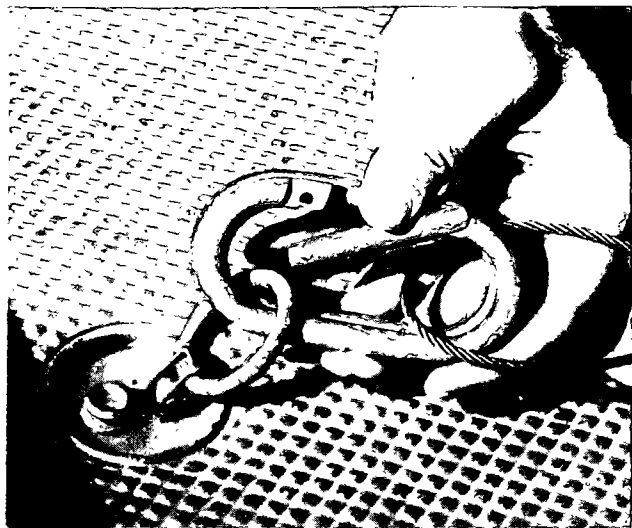


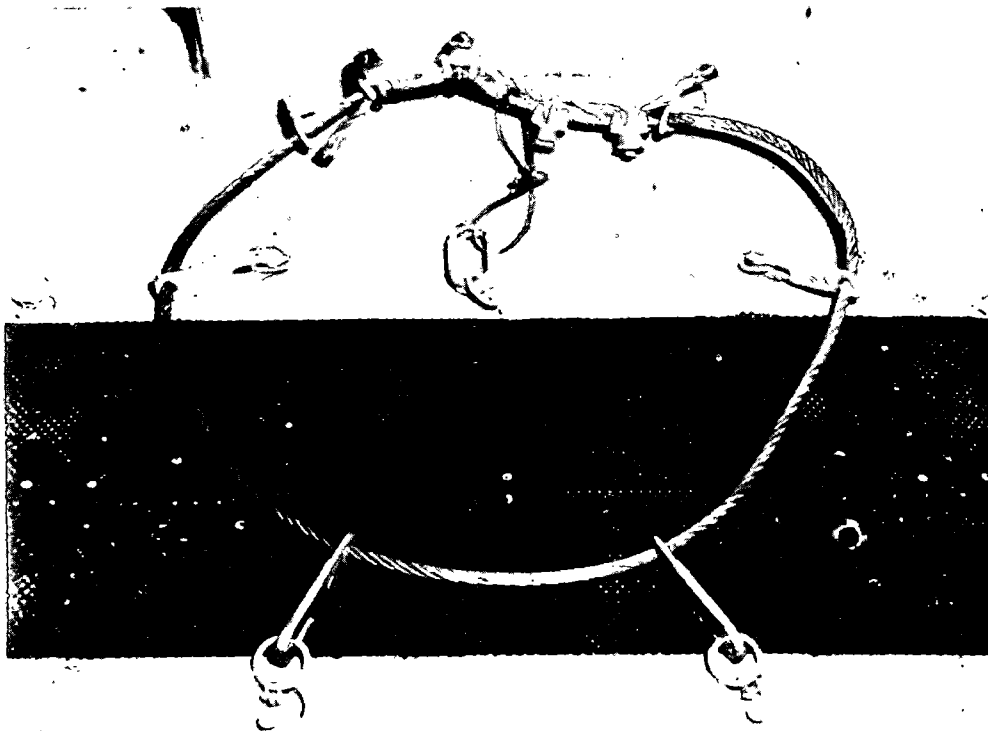
Figure 44. Donut ring attached to the floor of the helicopter.



①



②



③

Figure 45. Floating safety ring formed with two snaplinks.

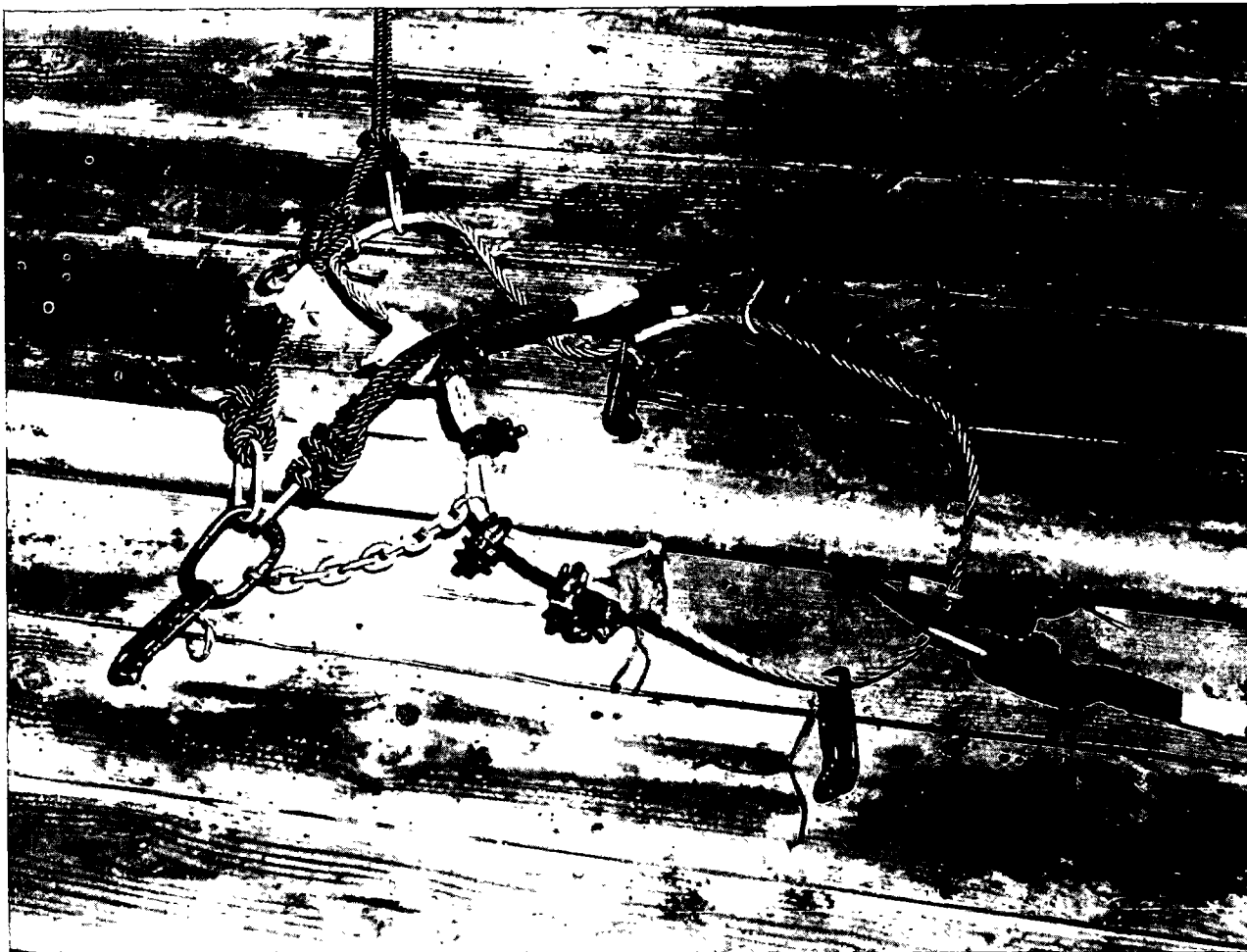


Figure 46. Donut ring on the tower.

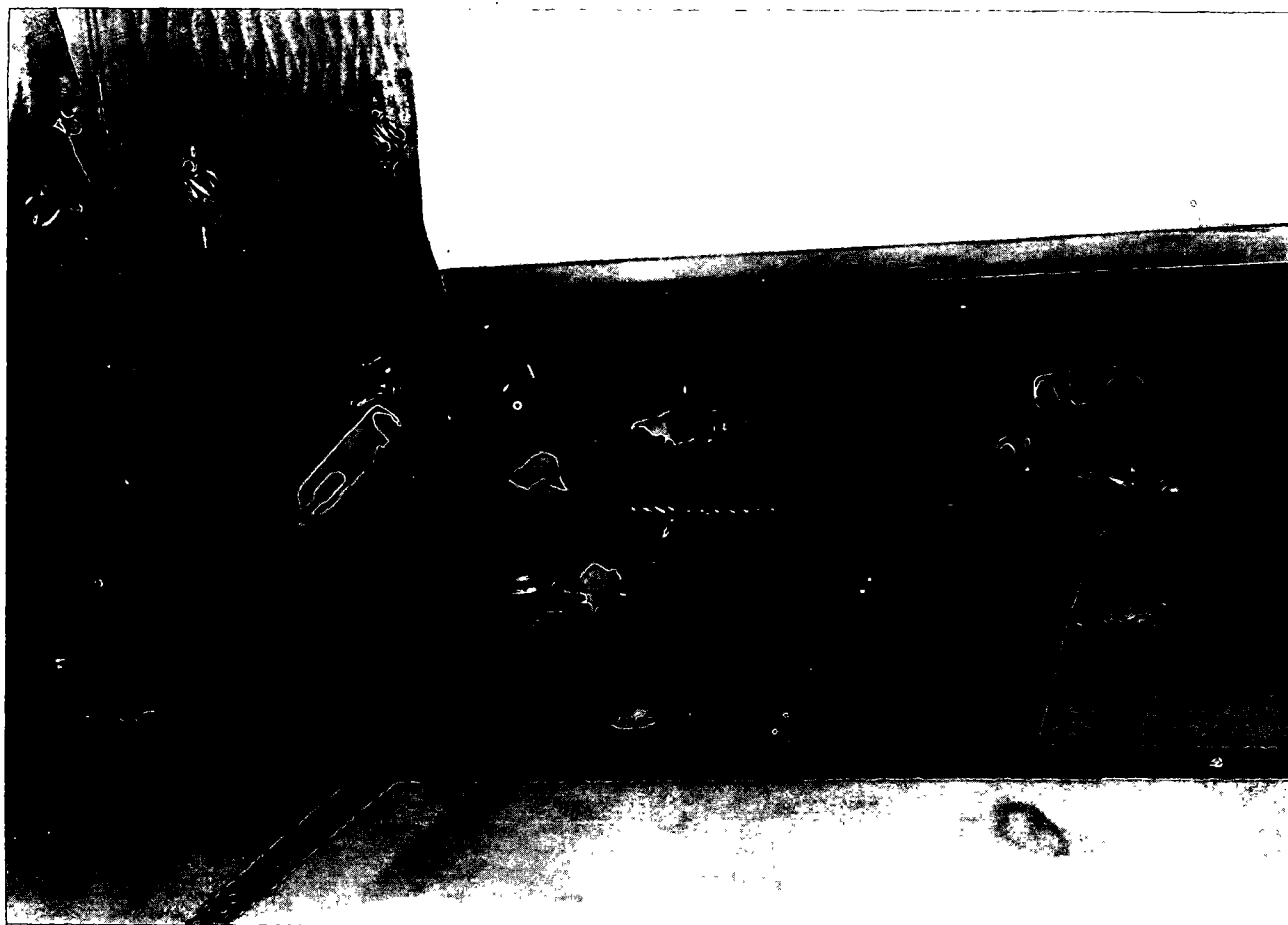


Figure 47. Donut ring and rappel rope connection in the helicopter.

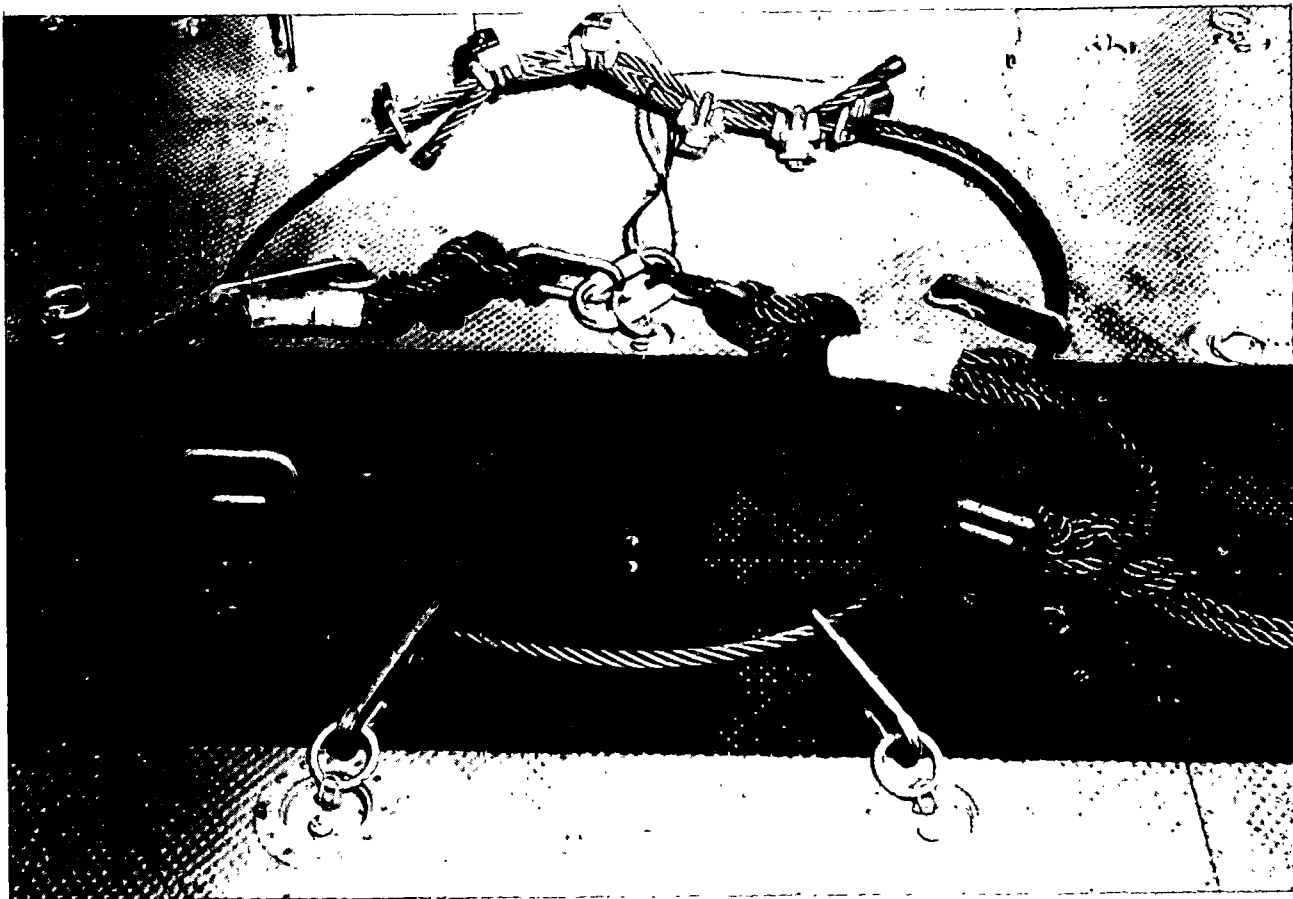


Figure 48. Rappel rope connection using two snaplinks for the floating safety ring.

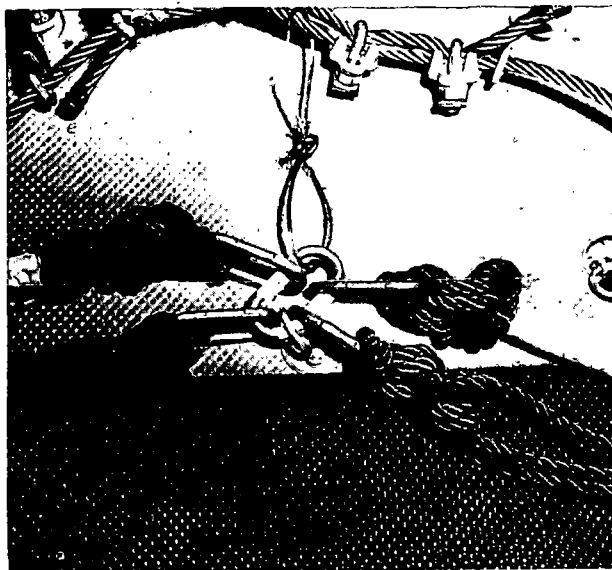


Figure 49. Four rappel ropes connected to the floating safety ring (two snaplinks).

Section III. TOWER TRAINING PHASE

16. General

The 35-foot training tower (fig 50) is designed to facilitate training the individual in rappelling techniques that will actually be used from a helicopter. The tower has a platform with a rail around two of the four sides. One side has a vertical board wall constructed from the platform to the ground with a minimum width of 6 feet. (This side is free of any obstacles in order to give the rappeller a clear approach and descent.) The second open edge of the tower platform (used for free rappelling) will be similar to the edge of the door of a UH-1D helicopter. A skid gear or suitable pipe substitute will be attached to the tower 3 feet below the top of the edge of the platform. A donut ring will be rigged to the tower platform for the anchoring of the rappelling ropes. The construction of the tower, to include the stairway or ladder system, will be the responsibility of the using unit.

17. Purpose

The 35-foot tower is used to assist in teaching the basic rappelling techniques and all the points of performance used in rappelling. For ease in training, the instruction is divided into two phases: a wall training phase and a free rappel phase. The wall training phase provides an introduction to individuals who have had no previous rappelling training. This phase will also provide a refresher course for previously qualified rappellers. The free rappel side of the tower is used for rappelling and exit techniques, simulating helicopter techniques, and familiarizing the individual in rappelling with full combat equipment.

18. Preparation

The individual in charge of the tower phase of training is responsible for physically checking every item of equipment, to include the following:

a. The ladder and donut ring require a thorough safety check prior to use.

b. The floor of the tower platform and the vertical wall will be inspected to insure that they are dry, clean, and free of hazards.

c. Structural lumber and timber of the tower will be checked prior to the start of each rappelling period.

d. The rappel equipment will be spread out neatly and checked to insure that all of the equipment is safe and operational.

19. Organization of the Tower Period

a. Personnel requirements include a minimum of one safety officer, one principal instructor, and three assistants to operate the rappelling tower. Each will be fully qualified in all phases of rappelling. There will always be an instructor on the platform of the tower and one at the foot of the tower during operations.

(1) *Instructors.* An assistant instructor will be positioned on the tower platform at each rappelling rope to insure the proper hookup of the rappellers. An assistant instructor will be at the foot of the tower to control the ground safety men and to make corrections when the rappeller reaches the ground.

(2) *Ground safety men.* There will be one man holding the ground end of each rope. The primary function of this man is to brake rappellers who lose control during descent. This is accomplished by simply walking away from the tower with the ends of the rappelling ropes, thereby taking the slack out of the ropes. These men may be individuals awaiting their turns to rappel.

(3) *Rappellers.* Two men will be on the platform preparing to rappel. One will be at the top edge of each ladder observing the two rappellers. One man will be at the foot of each ladder on the ground. Everyone will be *alert* and take *all* instructions from the instructors.

b. Requirements, rules, and procedures as they pertain to a particular tower will be explained in detail prior to actual rappelling.

c. An assistant instructor will demonstrate a minimum of two free rappels from the skid side

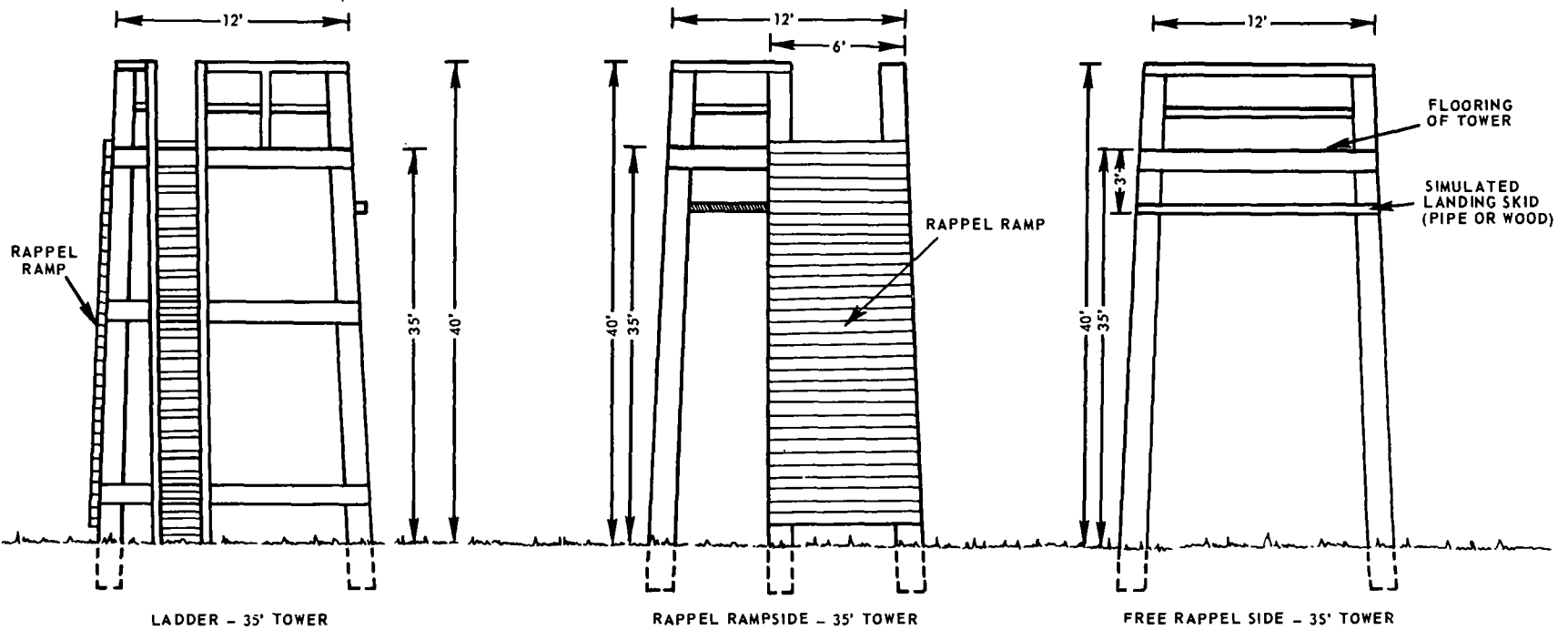


Figure 50. Schematic three-vein diagram of tower construction.

of the tower: one without equipment and one with combat equipment and rifle.

d. Each individual will adjust the rappel seat (or harness if used) and attach the snaplink in the proper manner. The instructors will inspect each trainee to insure the proper attachment of all items (fig 43).

e. When a long wait is necessary because of limited tower handling capacity or equipment shortage, individuals may be placed on concurrent training in construction of a rappel seat and knot tying.

f. When preparing to rappel from the tower, the trainee will first hook up his rappel rope to the anchor system on the tower as outlined in paragraph 14. He will then move to a position 3 to 4 feet from the exit edge of the tower. Right-handed personnel will be on the left side of the rope facing the donut ring, since the right hand is the brake hand. Left-handed personnel will be on the right side of the rope facing the donut ring, since the left hand is the brake hand. The rappeller will face the rappel rope, place it through the snaplink, and bring the standing part of the rope through the snaplink again so he has a full turn through the snaplink (fig 51). One additional full turn should be placed thorough the snaplink if the rappeller's weight exceeds 190 pounds. If the rappeller is wearing the rappel harness with rappel ring, he must not hook up his rappel rope to the anchor system until he has routed the rope through the rappel ring twice (unlike the snaplink, the rappel ring has no opening gate) (fig 52). The rappeller will insure that he has enough slack between the donut ring and himself to reach the edge of the tower. All actions of the rappellers on the tower will be monitored and supervised by a qualified instructor.

20. The Rappelling Commands

All commands are issued orally and are confirmed orally by the rappeller prior to executing them. The principal instructor during tower training, or the safety NCO during heli-

copter training, will issue the commands in the following order:

a. **GET READY!** The rappeller will look toward the donut ring and pull the rope to check the anchor point connection. He will then check the rappel seat and snaplink (or the rappel harness and rappel ring) to insure that the rope is properly inserted. The rappeller will then report "Ready," and place his brake hand in position behind his right (left) buttock with his brake on (fig 53).

b. **SIT IN THE DOOR!** The rappeller swings his legs around to the outside edge of the tower (helicopter) and takes up the sitting position (fig 54).

c. **DROP ROPE!** The rappeller drops his coiling log with rope out and away from the tower (helicopter) with his guide hand. He will insure that the rope does not fall between the side



Figure 51. Placement of the rappel rope through the snaplink.



Figure 52. Placement of the rappel rope through the rappel ring.

of the tower (helicopter) and the skid gear. The rappeller (and safety NCO) will lean out to observe that the rope is touching the ground and that it is not knotted or tangled. The rappeller will then tell the safety NCO "Rope okay."

d. POSITION! The rappeller then makes use of his guide hand and the anchor end of the rope to assist in pivoting 180 degrees on the skid (fig 55). He assumes his position by facing the tower (interior of the helicopter) with his brake hand on his buttock, feet spread shoulder width apart, balls of the feet on the skid, knees locked, and bent at the waist toward the tower (helicopter) forming an "L" body position (fig 56). At this point, the rappeller and the safety NCO conduct their final visual inspection of the snaplink or rappel ring.

e. GO! The safety NCO will designate a rappeller to exit by shouting the command and pointing at the rappeller with his extended arm

and finger. The rappeller flexes his knees and jumps backward, letting the rope run through both brake hand and guide hand (fig 57). He descends by dropping 5 to 10 feet at a time. During descent, the feet are kept together and the legs are straight while maintaining an "L" body position. The rappeller will look at the ground during his descent (fig 58). Upon reaching the ground and backing all the way out of the rope, the rappeller shouts "Off rappel," and moves quickly away from the tower.

21. Alternate (Cross-Chest) Method of Braking When Rappelling (for Special Rappels)

In addition to the method of braking whereby the rappel rope is routed around one side of the rappeller's waist and the brake hand is held against the buttock, there is another approved method of braking when rappelling. In this method, the cross-chest brake, the rappel rope is routed through the snaplink or steel ring on the rappel seat or rappel harness, around one side of the rappeller, and along his back to the other side where the rope rests in the rappeller's brake hand. To brake in the cross-chest method, the rappeller merely moves his brake hand toward his chest as in a curling exercise (fig 59). In this method of braking, the rappeller must insure that he removes all the individual items of equipment from his pistol belt to preclude the rappel rope from becoming entangled in them (since the rope is routed all the way around his waist). The alternate method is normally used only when rappelling with heavy equipment and/or through dense vegetation when the brake hand may be needed to clear away foliage under and/or around the rappeller. It provides a comfortable brake over an extended period and does not restrict rapid descent.

22. Safety Rules for Tower Training

The following are rules that will exist in all units conducting tower training. The unit may, however, enforce its own rules in addition to those listed.



Figure 53. Rappeller on helicopter after looking up and checking his equipment.

- a. Gloves are required for all rappel training.
- b. All instructors on the tower will wear safety lines.
- c. Instructors will be alert for overconfidence and carelessness.
- d. Instructors will insist on strict attention to detail.
- e. Instructors will note and report to unit commanders those students who are inept, show lack of confidence, or refuse to rappel.
- f. Unit commanders will insure that all personnel are completely tower qualified before beginning aircraft rappels.
- g. A medic with aid kit will be present during all training operations.

23. Equipment To Be Worn During Rappelling Operations

- a. A steel helmet with chinstrap fastened will be worn at all times when on the tower or rappelling. If available, the parachutist's chinstrap should also be worn to firmly secure the helmet.
- b. Gloves.
- c. Pack and/or rucksack and web equipment will be worn as dictated by the individual in charge of the training.
- d. The rifle must be slung diagonally across the back, sling tight, with the muzzle down on the side opposite the brake hand.
- e. No equipment will be worn on the brake-hand side of the pistol belt.



Figure 54. Rappeller sitting in the door of a helicopter.



Figure 55. Rappeller's position on skid.



Figure 55.—Continued.

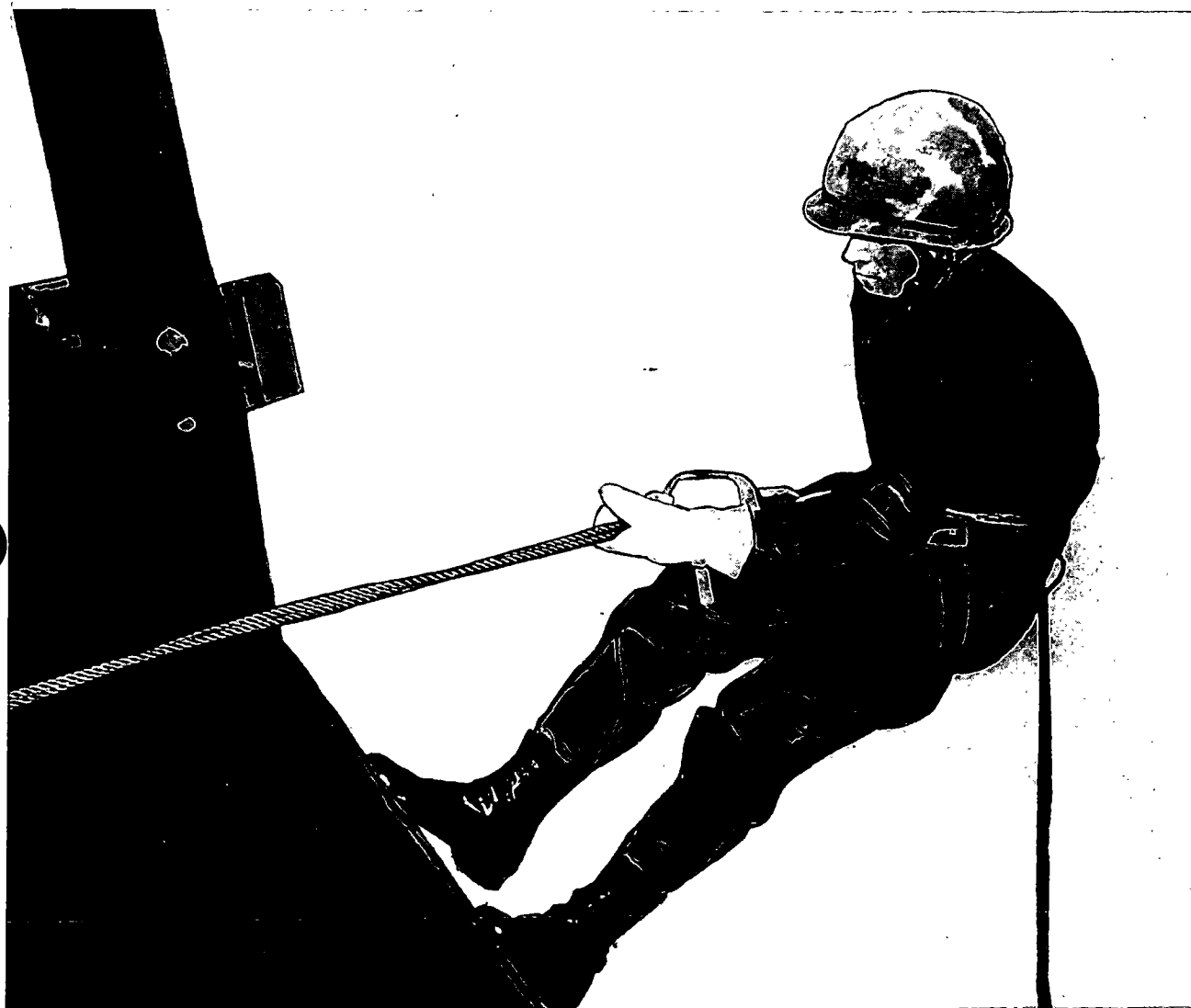


Figure 56. Rappeller in "L" body position.



Figure 57. Rappeller kicks away from skid.



Figure 58. Rappeller looks at ground during descent.



Figure 59. Alternate (cross-chest) method of braking.

Section IV. HELICOPTER TRAINING PHASE

24. General

Those personnel who have met the proficiency requirements in rappelling from the tower, and have the recommendation of the officer in charge of the tower phase, may progress to the helicopter rappelling phase.

25. Purpose

The rappeller will undergo training as covered in this section in order to become qualified in the technique of rappelling from a helicopter.

(After successful completion of this training, the rappeller may be required to rappel from a helicopter in any given combat situation.)

26. Capabilities of the Helicopter

The UH-1 series helicopters will be used in helicopter rappelling. The UH-1D or UH-1H is the preferred aircraft for rappelling operations.

a. Four rappellers and one safety NCO are considered a standard load for the initial training from a UH-1D or a UH-1H. The helicopter

may carry up to eight rappellers in an advanced training phase or combat situation.

b. Two rappellers and one safety NCO are considered a standard load for the initial training in either the UH-1B or UH-1C. These helicopters may carry up to five rappellers in an advanced training phase or combat situation.

c. There will never be more than one rappeller on the rappelling rope. The second rappeller may begin his rappel after the first rappeller is *off rappel*.

d. During combat operations, the standard load will be determined by the aircraft commander. This decision will be based on the capabilities of his aircraft (taking density altitude, fuel, and the like, into consideration).

e. During tactical exercises, four rappellers may take up positions on the helicopter skids prior to entering the drop zone.

27. Rigging of the Aircraft

The aircraft should be rigged for rappeling in the following manner:

a. All seats will be removed from the cargo compartment of the helicopter. Both cargo compartment doors will be locked in the open position. If the locks are not present, the doors will be removed. The small cargo doors will also be removed.

b. All sharp edges on the floor, door ledge, and the protrusions on the skids will be padded and taped. Each door ledge should also have a scuff board to insure that the rope will not make contact with the metal door ledge (fig 60).

c. The donut ring is secured to the center of the floor of the helicopter. There are six snaphooks on the donut ring, numbered clockwise with 12 o'clock being toward the front of the helicopter. The clamps of the donut ring are positioned toward the aft end of the helicopter. The floating safety ring is then placed within the donut ring and fastened with a snaphook to the single tie-down ring (fig 44).

d. Secure two snaplinks on the rappelling rope approximately 18 inches apart by using two anchor knots (round turn with two half hitches). Secure the snaplinks to the donut ring and the floating safety ring with the gates up to facilitate visual inspection by the safety NCO. There will be no slack between the rappeller and the initial anchor point.

28. Duties of the Safety NCO (Officer)

The safety NCO (officer) will wear a headset at all times and maintain constant two-way interphone communications with the pilot. In addition to his individual equipment, he will carry a sharp knife. The safety NCO remains with the aircraft and does not rappel.

a. Briefing.

(1) The safety NCO will conduct a briefing with both pilots of the helicopter. This briefing will include all procedures to be followed in the event of any emergency situation involving rappellers or the aircraft (para 31).

(2) The safety NCO will then conduct his briefing with all rappellers. This briefing will include all procedures to be used if any rappeller or the aircraft encounters an emergency situation.

b. Inspection.

(1) He will inspect the aircraft for rigging and insure that the anchor system is properly installed. He will also inspect for proper padding and taping of all sharp edges on the aircraft (fig 60).

(2) The donut ring and floating safety ring will be checked to insure that the rappelling ropes are properly secured by the snaplinks.

(3) The safety NCO will then check the rappellers to insure that they have the proper hookup with the rappelling ropes.

c. He will verify that the ropes are touching the ground and are not tangled after he has directed DROP ROPES. The aircraft must be at a stationary hover before the ropes are dropped. If the ropes become entangled with trees, the safety NCO will make one attempt to untangle the ropes by vigorously jerking the



Figure 60. UH-1D helicopter rigged for rappelling.

ropes upward. If the ropes remain entangled, they may become a hazard to the aircraft, in which case the safety NCO will release or cut the ropes immediately.

d. During all rappelling operations, the safety NCO will release the ropes from the aircraft only after insuring that all rappellers are off *rappel*.

e. The safety NCO will give "ALL CLEAR" to the pilot before the aircraft leaves the hover position.

29. Seating Arrangements and Positions in the Aircraft

All rappellers will be completely hooked up to

the donut ring and use safety belts while in flight. For safety emphasis during flight each rappeller's brake hand is in position with no slack in the rope between the brake hand and the donut ring. The rappeller will insure that his rappelling rope is not tangled on any part of the interior of the helicopter or his equipment. He will insure that the coiling log is located in such a position that he can drop the rope with ease, using his guide hand. The coiling log will be secured with half under the rappeller's inside leg and the other half on top of his outside leg (fig 53).

a. The forward (two) rappellers sit along the leading edge of each door and face to the rear

of the helicopter with their legs extended. The rear (two) rappellers sit along the rear edge of each door, facing to the front of the helicopter with their legs extended. The safety NCO sits in the center in order to facilitate his visual inspection of all personnel and equipment (fig 60).

b. For a forecast flight time of less than 5 minutes, and for training and operations where speed is a factor, the safety NCO may direct the rappellers to be seated in the door facing outward and with their feet on or reaching for the skid. In a tactical situation and prior to the helicopter coming to a hover, the rappellers may assume an upright position facing inside the helicopter.

c. The aircraft should be cleared as expeditiously as possible to reduce to the minimum the time that the aircraft is in the critical high-hover flight condition.

30. The Command CO

a. Rappellers exit in the sequence of left front and right rear men followed by the left rear and right front men. The only alternate sequence of exit is the right front and left rear followed by the right rear and left front.

b. On the command of GO, each rappeller will flex at the knees and vigorously push away from the skid gear, allowing the rope to pass through his brake hand and guide hand. The descent should be accomplished as smoothly as possible, avoiding any jerky stops, and at a rate of approximately 8 feet per second. The rappeller will initiate his braking action slowly, when he is approximately halfway to the ground. The safety NCO will insure that there is at least a 5-second delay between each rappeller in the early phase of training. Emphasis is placed by the rappeller on the following points of performance: feet together, particularly if over woods or jungle, and use of the guide hand only (not the brake hand) to remove any entanglements.

c. Upon reaching the ground, the rappeller will clear the rappel rope through the snaplink (or rappel ring) until it is free. If additional

rappellers are to follow on the same rope, the rappeller on the ground will separate and untwist the ropes for each subsequent rappeller. If ropes are to be released from the aircraft following the last rappeller, it is not necessary to first untwist and separate the ropes. At least a 5-second interval should be maintained between exit groups (two men exiting simultaneously).

d. The safety NCO will release the rope from the donut ring after he confirms, by visual inspection, that the rappeller is off rappel. He then drops the rope away from the helicopter.

31. Emergency Procedures

All rappellers and helicopter pilots will be briefed by the safety NCO on the procedures to be followed in the event of an emergency situation involving the helicopter, rappellers, or ropes.

a. *Helicopter.* If the helicopter experiences any emergency during rappelling operations, the rappellers will complete their descent as rapidly as possible. Upon reaching the ground, each rappeller will run away from the area beneath the helicopter while keeping the end of the rappelling rope with him. The helicopter will attempt to move forward before settling to the ground.

b. *Rappeller.* In the event a rappeller is unable to complete his descent, the following actions will be taken:

(1) If the rappelling rope is knotted or tangled below the rappeller, the helicopter will move to a clear area and lower the rappeller to the ground. The safety NCO will release or cut the rope as soon as he sees the rappeller reach the ground.

(2) If the helicopter inadvertently gains altitude above the height of the rope, the rappeller will immediately apply his brake and wait until the rope touches the ground before he continues his rappel.

c. *Ropes.* If the ropes become entangled with the ground (stumps, rocks, or any debris), the safety NCO will release or cut the ropes.

Note. The training site for the initial qualification period should be clear of any obstacles such as trees, stumps, rocks, or heavy brush.



Figure 61. Rappelling from UH-1D helicopter with ground safety men.

32. General Requirements for Helicopter Rappelling

a. Prior to rappelling, personnel will receive instruction on hooking up inside the aircraft, attachment of rappelling ropes and snaplinks, seating, and procedures for dropping ropes. All safety measures will be stressed. This instruction will be accomplished as concurrent training in tower areas, and will include a demonstration on coiling the rope on a log. Rappellers will undergo this training until they are proficient enough to safely execute each phase of rappelling. Safety NCO's will doublecheck each rappeller before he enters or exits an aircraft.

b. Qualifying exits for rappellers will be over a cleared area. This area may have waist-high grass but will be completely clear of trees, stumps, rocks, and other debris.

c. Rappellers who display a lack of proficiency will be returned to the tower for additional training.

d. All rappelling operations will be conducted with a double rope.

e. FM radio communications will be established at the rappelling site during all aircraft rappelling operations. Radio operators will be alert to insure that aircraft do not attempt to depart from the hover position with ropes attached.

f. Four ground safety personnel will be used for each aircraft during the period of basic

qualification. These men will take positions directly under the ropes, grasp the ropes, and be prepared to "brake" the rappellers if necessary. These men will take their positions immediately after the ropes are dropped (fig 61).

g. Plastic goggles will be worn for protection from dust and sand during aircraft rappelling by ground safety men, rope retrieving details, and any control personnel required to be within the rotor wash area.

h. The safety NCO will wear a safety line when the aircraft is airborne.

i. The officer in charge will coordinate with the pilot prior to an exercise in order to mark rappelling areas, give wind direction, coordinate safety procedures, check radio frequencies and call signs, and to make any necessary changes.

j. After the pilot hovers the helicopter into the wind, he will make the final decision as to whether or not rappelling operations can be conducted safely.

k. There will be a standard exit sequence and a 5-second delay between exit groups.

l. Medical support will include one aidman during all training. A vehicle is desirable but not mandatory. During helicopter training, the helicopter will be utilized to evacuate any seriously injured personnel to the nearest medical facility.

APPENDIX H (ADDED)

TROOPER LADDER

1. General

This appendix explains the techniques and procedures required for the use of the trooper ladder from the CH-47 Chinook helicopter (fig 62).

2. Procedures for Use of the Troop Ladder

a. An inspection of the trooper ladder will be

conducted prior to use by the crew chief and/or flight engineer. This inspection will include the following:

(1) Check for oil or grease on the ramp.

(2) Check for frayed cables.

(3) Insure all aluminum tubes are secured to the cables, check for cracks.

(4) Check all snaphooks on both ends of

the ladder (three to each end) and insure that the safety pins are present and in place.

(5) Check for any sharp pieces of metal or extending wires which may cause cuts or scratches.

b. The troop commander will brief all troops on the following:

(1) Use the legs for climbing and descending, the arms for stabilization and holding the ladder close to the body.

(2) Only five to six men will be on the ladder at one time. The crew chief and/or flight engineer will control the rate of flow down the ladder, and the troop commander will control the rate of flow up the ladder.

(3) Personnel will unstrap seat belts and approach the ladder only when directed by the crew chief or flight engineer.

(4) When descending, the first man on the ground will steady the ladder for the remaining troops. When ascending, the man who is designated to hold the ladder steady is the last man up, he should be the most physically fit since his ascent will be the most difficult.

(5) The aircraft will not make erratic movements intentionally. Personnel using the ladder should remain calm at all times.

(6) Upon reaching the ground, personnel should move quickly from beneath the helicopter and deploy as directed by the troop commander.

(7) All weapons will be secured to the body so that both hands can be used on the ladder. Weapons should be slung diagonally across the back with the muzzle pointing up when descending the ladder and down when ascending the ladder. This precludes the muzzle of the weapon from becoming entangled in the rungs of the ladder.

(8) Emergency procedures:

(a) If the aircraft begins settling toward the ground with personnel on the ladder, they should stay calm, remain on the ladder, and watch the ground. As each man reaches the ground, he rapidly exits the ladder and moves from beneath the helicopter.

(b) If the aircraft comes under fire, no additional personnel will use the ladder. The

aircraft will depart the area until it can be secured again.

3. Installation of the Trooper Ladder

a. *On the Rear Ramp.* The handrail is installed on the rear end of the ramp with approximately 4 inches extending out over the ramp edge. It will be secured to two 5,000-pound tiedown straps (MC-1) attached to sta-

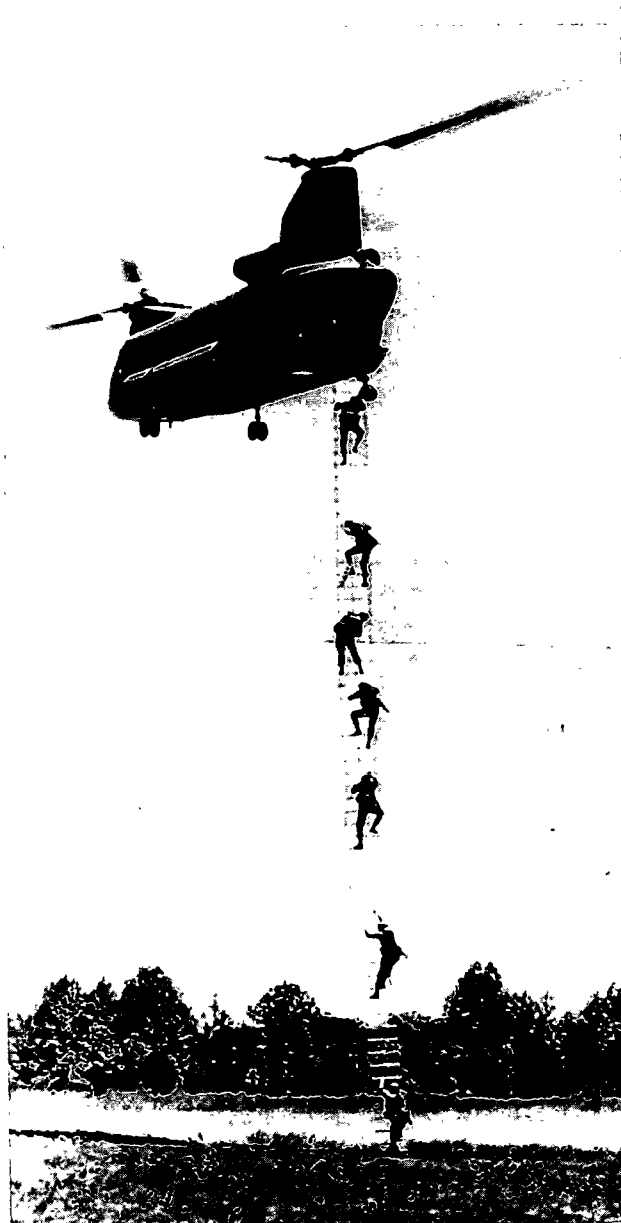


Figure 62. Trooper ladder.

tion 481.8 and extending through the forward ends of the handrail and attached to station 492.6. The ladder itself is fastened onto the rail with the use of three snaphooks which are safety-tied to the ladder. After installation, the ladder is rolled up and placed forward of the installed handrail inside the aircraft (fig 63).

Note. No more than 3,000 pounds downward pressure should be applied to the rear ramp.

b. On the Utility Hatch. The cargo hook, rail, and access door must be removed for ladder installation. The handrail is installed facing the same direction as the rear ramp rail. Secure it in the same manner, using the 5,000-pound tie-down points and standard tiedown straps. The ladder is rolled and secured beneath the utility door access with a standard tiedown strap.

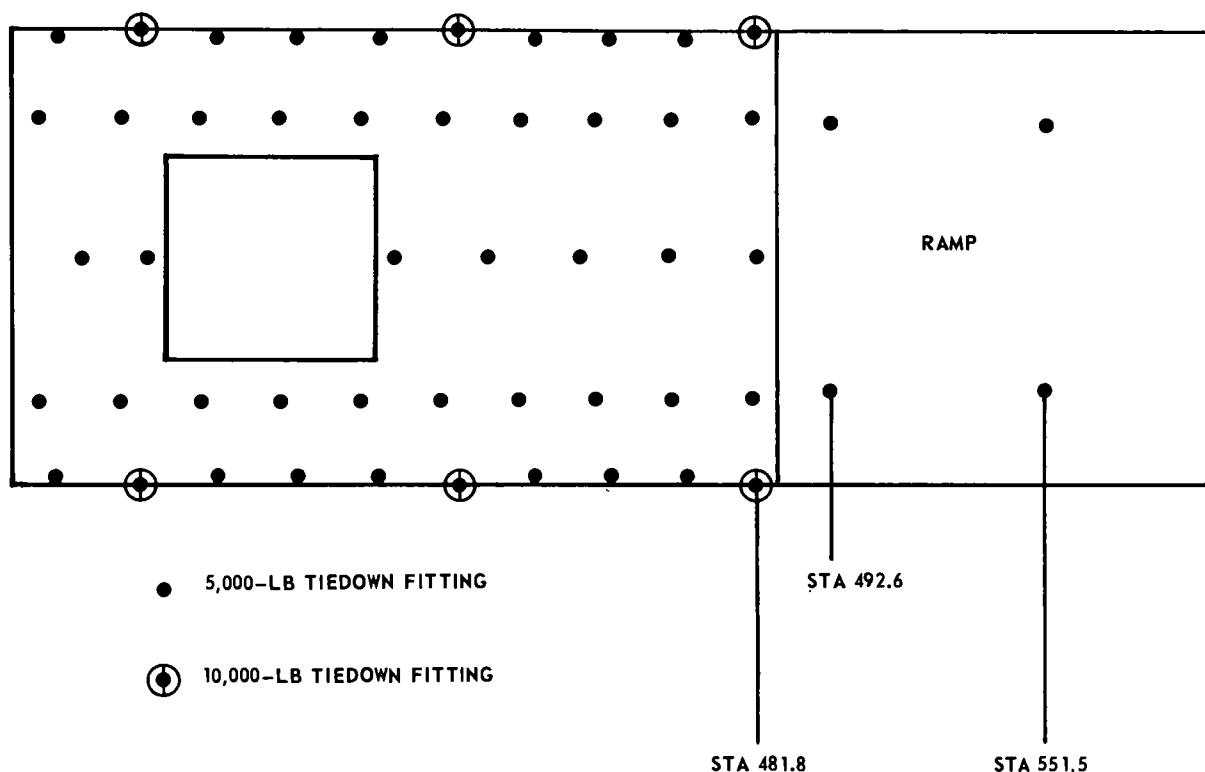


Figure 63. Tiedown fittings, CH-47 helicopter.

APPENDIX I (ADDED)

DENSITY ALTITUDE COMPUTATIONS

1. Measuring Density Altitude

a. Density altitude computations are relative to aircraft load capacity based on existing weather conditions.

b. No instrument is available for measuring density altitude directly. It must be computed from the temperature and pressure at the particular altitude under consideration.

c. As a field expedient, the chart for computing density altitude (fig 64) should be used, keeping in mind that the results are based on variables and must be considered as close approximations.

2. Compute Density Altitude as Follows

a. Determine barometric pressure for point of takeoff and landing. *Example.* 28.60" Mercury.

b. Determine field elevation at point of takeoff and landing. (Use map for reference.) *Example.* 2,000 feet.

c. Apply altitude addition/subtraction to field elevation obtained in b above. Use amount corresponding to appropriate barometric reading found in a above. (Readings shown in two columns on right of chart.) *Example.* Pressure altitude = $1245 + 2000 = 3,245$ feet.

d. Obtain outside air temperature at field elevation of point of takeoff and landing. *Example.* 95°F (35°C).

e. Move a pointer horizontally along tempera-

ture scale at bottom of chart to degree reading obtained from d above, then vertically along temperature line until pointer intersects the diagonal pressure altitude line from c above. (Compute as necessary.)

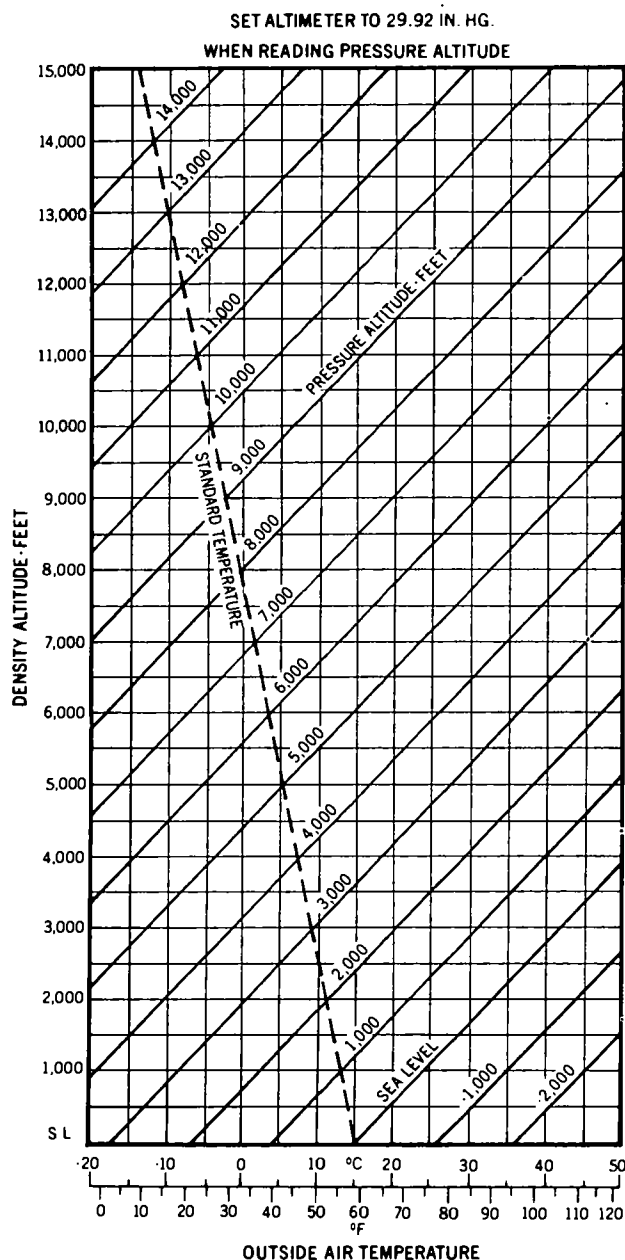
f. Move pointer horizontally to the left and read resultant density altitude in feet. *Example.* 6,400 feet.

3. Field Expedient

A field expedient means of determining barometric pressure is to set the field elevation on an altimeter and read the barometric pressure from the Kollsman window. *Example.* From a map is determined that the elevation of a site is 1,225 feet; set this reading on the face of the altimeter, and the resultant pressure shown in the Kollsman window is approximately that of the operational area.

Page 73. glossary, Contour Flying. In line 5, "prints" is changed to read "points".

Page 73, glossary, Control Center. In line 3, "landing drop zone" is changed to read "landing/drop zone".



ALTIMETER
SETTING
IN. HG.

ALTITUDE ADDITION
FOR OBTAINING
PRESSURE ALTITUDE

28.0	1,825
28.1	1,725
28.2	1,630
28.3	1,535
28.4	1,435
28.5	1,340
28.6	1,245
28.7	1,150
28.8	1,050
28.9	955
29.0	865
29.1	770
29.2	675
29.3	580
29.4	485
29.5	390
29.6	300
29.7	205
29.8	110
29.9	20
29.92	0
30.0	-75
30.1	-165
30.2	-255
30.3	-350
30.4	-440
30.5	-530
30.6	-620
30.7	-710
30.8	-805
30.9	-895
31.0	-965

Figure 64. Chart for computing density altitude.

FM 57-38

C 1

By Order of the Secretary of the Army:

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Distribution:

To be distributed in accordance with DA Form 12-11 requirements for Pathfinder Operations.



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CHANGE }
No. 2 }

**HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 March 1973**

PATHFINDER OPERATIONS

FM 57-38, 9 October 1968, and Change No. 1, are changed as follows:

Page 2, figure 6, as changed by C 1. Caption under figure is changed to read, "Night UH-1 landing site, flights heavy left sections in trail formations."

Page 4, paragraph 3a(9). Line 3 is changed to read, "cloud cover, visibility, and approximate ceiling."

Page 4, paragraph 3a(9). Line 4 is deleted.

Page 4, paragraph 3b(4) added. "(4) Four fire support bases simultaneously."

Page 4, paragraph 6b(1). Line 6 is changed to read "aid." Remainder of line 6 and lines 7-12 are deleted.

Page 4, paragraph 6c. Line 3 is changed to read, "25 radio, the AN/PRC-77 radio with secure capability and limited wire equipment, insuring".

Page 5, paragraph 6f is added.

f. Vulnerability of Communication and Electronic Devices. All communication and electronic equipment such as radio, radar, and electro-optical devices which radiate electromagnetic energy are vulnerable to interception, analysis, direction-finding, and subsequent exploitation. The enemy's exploitation may be oriented toward gaining intelligence support for his fire and maneuver elements and/or toward obtaining supportive data for the conduct of electronic countermeasure operations. Thus pathfinders and terminal guidance personnel must be aware of hostile collection and exploitation activities which seek to disrupt, deceive, harass, or otherwise interfere with the command and control of friendly pathfinder operations. Although a distinct threat, the enemy's capability to exploit signal intelligence in support of his ground operations may be adversely affected by time-distance factors involved in

the dispatch of a reaction force and the time-consuming process of obtaining a direction-finding (DF) fix. Nonetheless, once a fix is obtained, he possesses the capability of resorting to electronic countermeasures (ECM)—i.e., jamming and deception—against electronic aids used in pathfinder operations. This threat can be significantly reduced through the adoption and enforcement of strictest signal security practices to minimize enemy exploitation through the adoption of procedures, including electronic counter-countermeasures (ECCM), to combat the effects of ECM if and when the latter is initiated by the enemy; and through friendly deception measures, including electronic deception. For further details regarding electronic warfare aspects see FM 24-18, FM 31-40, FM 32-5, and FM 32-20.

Page 5, paragraph 7c. In line 7, "Additionally, the training program must stress mission accomplishment in an electronic warfare environment" is added.

Page 7, paragraph 11. Line 3 is changed to read, "finder present must give his personnel a mission alert at the".

Page 9, paragraph 17. Line 3 is changed to read, "means. The means most often employed today is".

Page 13, paragraph 22f is added.

f. The heavy reliance on and use of radio in pathfinder operations presents the enemy with frequent opportunities for intercepting, analyzing, and exploiting friendly transmissions for the purpose of gaining intelligence and conducting electronic jamming and deception (para 6f). The means for defeating enemy jamming or imitative deception lie largely with the radio operator, who must possess proficiency in recognizing, reporting, and combating this deliberate interference by employing appropriate electronic counter-countermeasures (ECCM). Pro-

C 2, FM 57-38

visions for defense against electronic countermeasures, including transmission security and alternate means of communication, must be a part of the planning for and execution of the tactical mission.

Page 13, paragraph 23c. Line 3 is changed to read, "to augment pathfinder elements as directed by aviation unit SOP."

Page 16, figure 3 is superseded.

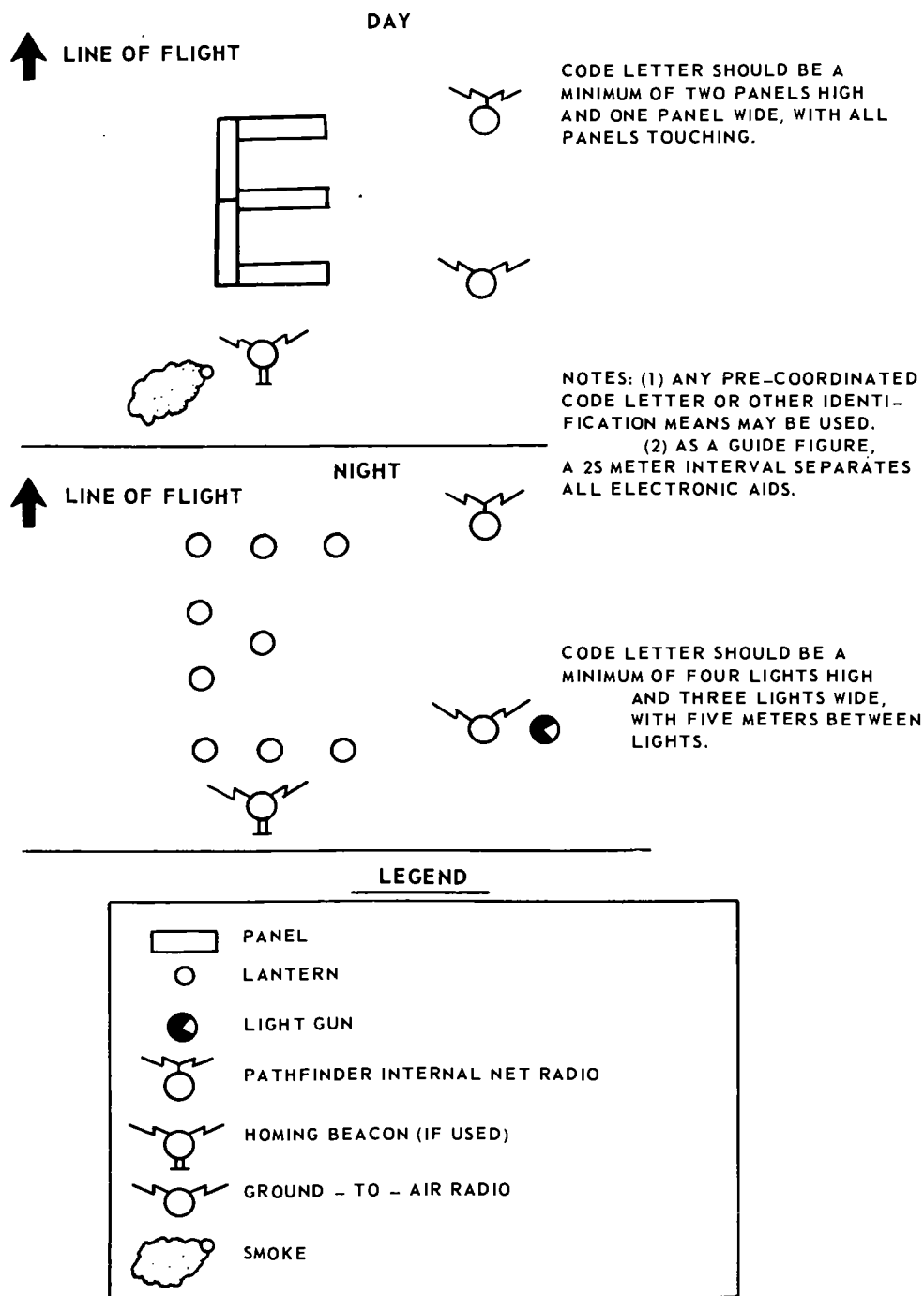


Figure 3. Release point (RP).

Page 18, paragraph 27b(1). In line 1, change title to read "Landing point (that area design-

nated by the commanding officer where the helicopter will touch down)."

Page 19, figure 4 is superseded.

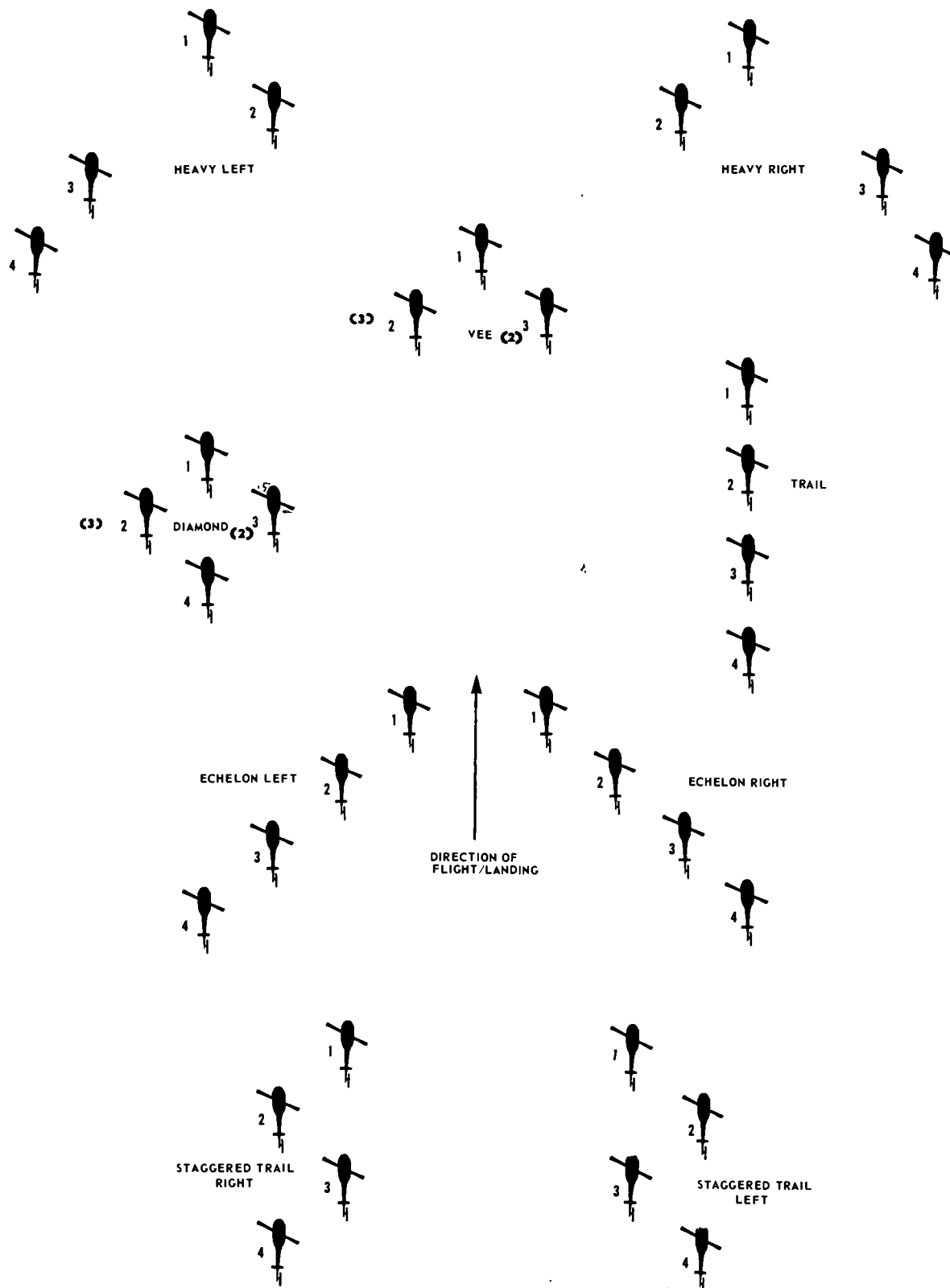


Figure 4. Standard flight and landing formations.

Page 20, paragraph 28a is rescinded.

Page 20, paragraph 28b. In line 1, designation b is deleted, and sentence changed to read, "The landing site party consists".

Page 20, paragraph 28. Designations (1), (2), and (3), are changed to read, "a., b., and c.".

Page 22, figure 5 is superseded.

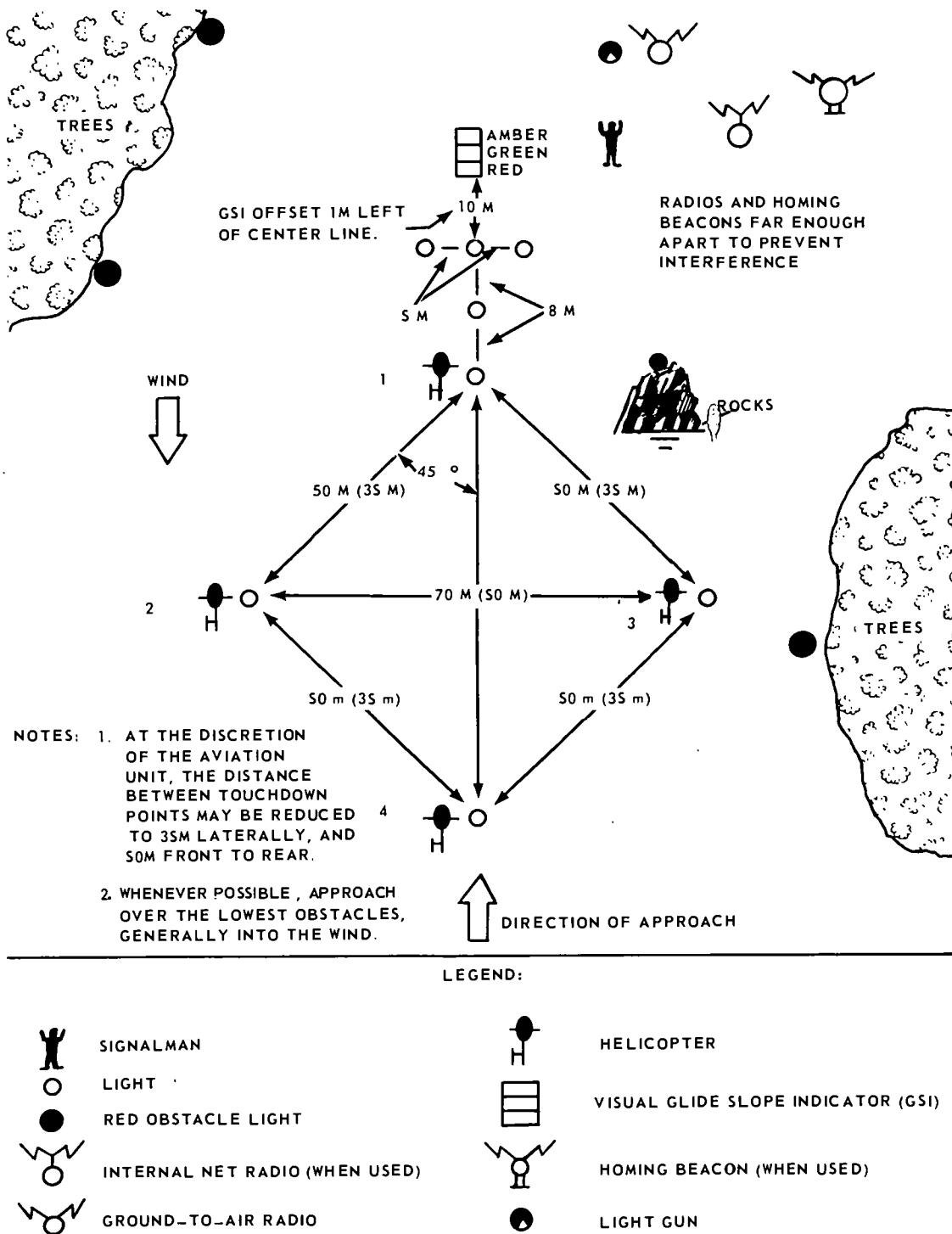
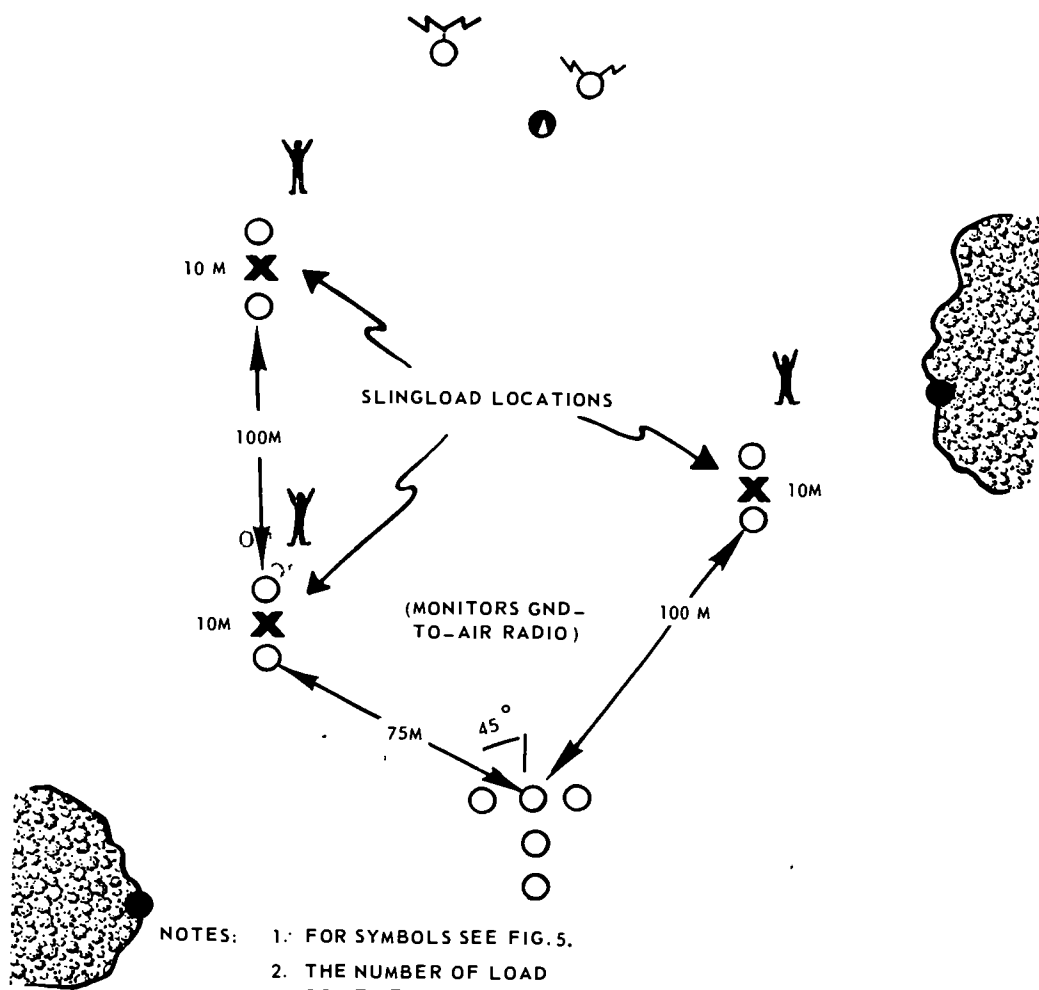


Figure 5. Night UH-1 landing site—diamond formation.

Page 26, figure 9 is superseded.



- NOTES:
1. FOR SYMBOLS SEE FIG. 5.
 2. THE NUMBER OF LOAD POINTS ESTABLISHED IS DETERMINED BY AVAILABLE AREA AND MISSION REQUIREMENTS.
 3. EACH AIRCRAFT MAKES APPROACH TO TEE AND HOVERS TO DESIGNATED LOAD POINT AT DIRECTION OF CC.
 4. HOOKUP MEN AT LOAD POINTS SHOULD BE PROVIDED BY LIFTED UNIT.
 5. PFDR INTERNAL NET MAY BE USED AS REQUIRED THROUGHOUT THE SITE.

Figure 9. Night CH-47 slingload pickup and/or drop zone.

Page 28, paragraph 30b. Sample radio message is superseded.

Speaker	Topic	Message
Flight leader	Identification, location	HOTEL CONTROL, THIS IS HAWK ONE AT CCP, OVER.
Pathfinder at landing site ..	Acknowledgment heading from CCP to LS.	*HAWK ONE, THIS IS HOTEL CONTROL; HEADING TWO EIGHT ZERO; LANDING SITE HEADING TWO NINER ZERO (OR, IF INTERCEPT HEADING IS REQUIRED: HEADING FROM RP THREE ONE ZERO TO INTERCEPT TWO NINER FIVE);
	Landing direction, other pertinent information.	*LAND TWO NINER FIVE; *ENEMY SITUATION NEGATIVE, SMOKE ON CALL, STUMPS ON LANDING SITE;
	Reporting point	*REPORT ONE MILE FINAL.
Flight leader	Acknowledgment	*HAWK ONE, ROGER OUT;
Flight leader	Identification, location	*HOTEL CONTROL, HAWK ONE; ONE MILE FINAL.
Pathfinder at landing site ..	Acknowledgment and final clearance to land.	*HAWK ONE, HOTEL CONTROL; WIND THREE ONE ZERO DEGREES AT FIVE, CLEAR TO LAND.
Flight leader	Acknowledgment	*HAWK ONE, ROGER.
Flight leader	Request for permission to take-off.	*HOTEL CONTROL, HAWK ONE; REQUEST TAKEOFF.
Pathfinder at landing site ..	Acknowledgment and instruction for takeoff.	HAWK ONE, HOTEL CONTROL; WIND THREE ONE ZERO DEGREES AT FIVE, CLEAR FOR TAKEOFF.

Page 31, figure 11 is superseded.

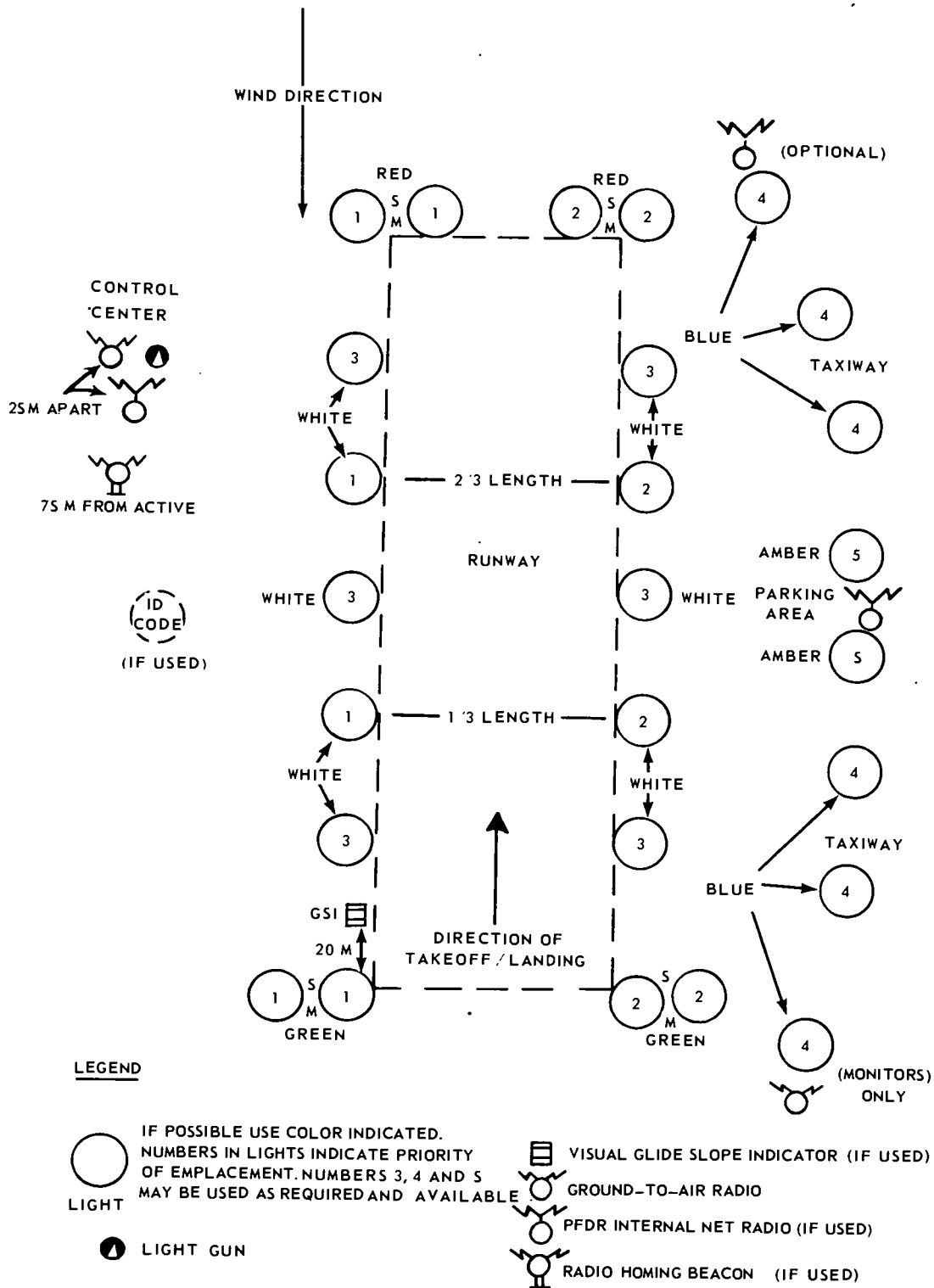


Figure 11. Airplane landing strip (night).

Page 32, paragraph 26a, as changed by C 1. Lines 3-5, "The helicopter may *** or combat situation." is deleted.

Page 33, paragraph 26b, as changed by C 1. Lines 3-5, "These helicopters may *** or combat situation." is deleted.

Page 35, paragraph 31, as changed by C 1. Line 2 is changed to read, "briefed jointly by the aircraft commander, and the safety NCO on the procedures to".

Page 36, paragraph 37b(3). In line 10 of Message change "STRIP FIRING ONE SEVEN ZERO," to read, "STRIP FIRING ONE SEVEN ZERO MAX ORD 4700, RANGE 7K,".

Page 36, paragraph 37b(5). In line 6 of Message change "TURN RIGHT END OF RUNWAY" to read "TURN RIGHT DEPARTURE END OF RUNWAY."

Page 37, paragraph 37e. The speaker-message-topic format is superseded as follows:

AIRPLANE LANDING STRIP

1. HEADING _____ (From CCP or a/c location, if required.)
2. ENTER _____ (Traffic pattern) RUNWAY _____
3. WIND _____ DEGREES AT _____
4. Include here any of the following information, if pertinent: Enemy situation, friendly fires, traffic conditions, obstacles, field elevation, condition of runway, smoke or light gun on call.
5. REPORT BASE/FINAL.

WHEN A/C REPORTS

6. WIND _____ DEGREES AT _____
7. CLEAR TO LAND.
8. (PARKING INSTRUCTIONS): _____

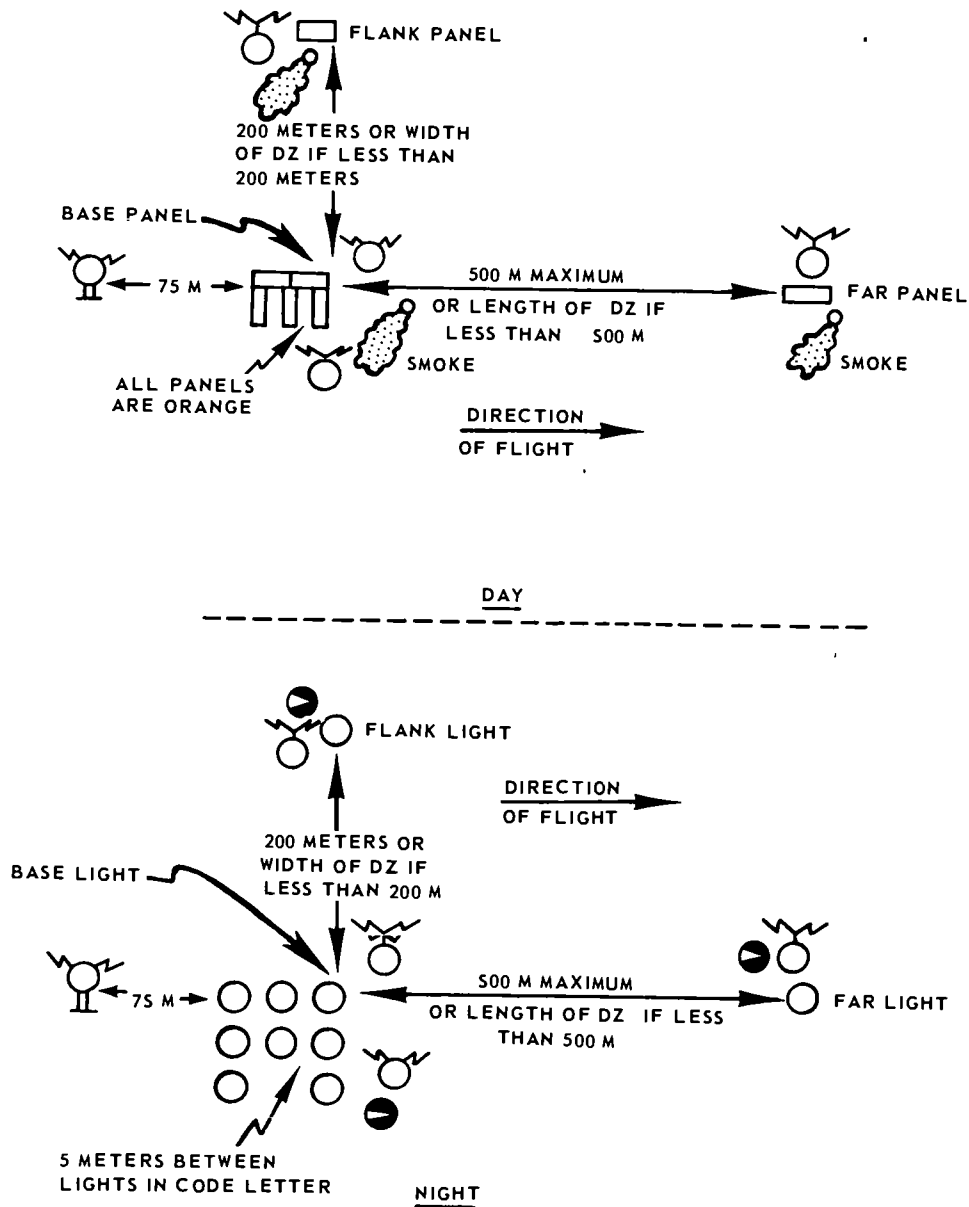
TAXI INSTRUCTIONS FOR DEPARTURE

1. TAXI TO _____ (Specific pt.)
2. WIND _____ DEGREES AT _____
3. HOLD SHORT OF ACTIVE. ADVISE WHEN READY.

TAKE-OFF INSTRUCTIONS

WIND _____ DEGREES AT _____
CLEAR FOR TAKE-OFF.

Page 42, figure 13 is superseded.



NOTE: WHITE LIGHTS ARE PREFERABLE; BLUE OR GREEN LIGHTS ARE DIFFICULT TO DETECT FROM RANGE.

NOTE: SEE FIGURES 11 & 12 FOR SYMBOL LEGEND

Figure 18. Day and night drop zone.

Page 45, appendix A, References, is amended as follows:

Added references:

FM 31-40, Tactical Cover and Deception (U).

FM 32-5, Signal Security (SIGSEC) (U).

FM 32-20, Electronic Warfare (Ground Based) (U).

Superseded references:

FM 61-24, Division Communications, supersedes FM 7-24.

FMs 7-10, The Rifle Company, Platoons, and Squads; 7-20, The Infantry Battalions; 7-30, The Infantry Brigades;

supersede FMs 7-11, 7-15, 7-20, and 7-30.

Rescinded references:

FM 31-30, Jungle Training and Operations.

FM 57-10, Army Forces in Joint Airborne Operations.

FM 57-100, The Airborne Division.

(CLASSIFICATION)

PATHFINDER OPERATION PLANNING FORMAT

ACFT NO	NAME	LOAD TIME	T O TIME	OUTY AND LOCATION	CALL SIGN & FREQ	EQUIPMENT	REMARKS
N/A	GUZMAN	N/A	N/A	SECTION CO, STAGE FLO DEKKAR STRIP, GL 934730	BLACKHAT 6, 34.50	4-PRC/25 RADIOS 24-VS/17 PANELS 35-MX/290 LANTERNS 3 SETS OF BATONS 1-SE/11 LIGHT GUN 1-ML/433 ANEMOMETER 3 COLOREO JACKETS EXTRA SMOKE	BE PREPARED FOR MIXED TRAFFIC AND NIGHT OPNS UNTIL RELIEVED.
N/A	NOBLE	N/A	N/A	G A RTO, STAGE FLO	DEKKAR CONTROL, 34.50		
N/A	SNIOER	N/A	N/A	INT NET RTO, STAGE FLO	CC, 66.20		HOMING BEACON FREQ 1750KC
N/A	TRUSS	N/A	N/A	SIGNALMAN, STAGE FLD	PARK, 66.20		
N/A	PYE	N/A	N/A	SIGNALMAN, STAGE FLD	HOT SPOT, 66.20		
750	MAC FARLANE	0540	0545	SITE CO, LZ ALBANY GL 055713	BLACKHAT 1, 40.20	2-PRC/25 RADIOS 12-MX/290 LANTERNS 1-SE/11 LIGHT GUN 1 SET DF BATONS 6-VS/17 PANELS 1-ML/433 ANEMOMETER 8 SMOKE GRENADES	ACCOMPANY A/1-188TH ON SEARCH & DESTROY OPERA- TION UNTIL COMPLETED.
750	RDBERTS	0540	0545	G A RTO, LZ ALBANY	ALBANY CDNTRDL, 40.20		
750	THOMAS	0540	0545	PFOR, LZ ALBANY	N/A		
777	WALLS	0535	0540	SITE CO, LZ MACDN GL 075720	BLACKHAT 2, 51.30	SAME AS FOR LZ ALBANY	ACCOMPANY B/1-188TH ON SEARCH & DESTROY OPERA- TION UNTIL COMPLETED.
777	KEARSE	0535	0540	G A RTO, LZ MACON	MACON CONTRDL, 51.30		
777	CAREY	0535	0540	PFDR, LZ MACON	N/A		
N/A	MESARIAK	N/A	N/A	SITE CO, STANOBY RE- SERVE VIC DEKKAR STRIP	BLACKHAT 3, 37.30	SAME AS FOR LZ ALBANY	REMAIN WITH C/1-188TH (RESERVE) AT DEKKAR STRIP; COMMITTED ON ORDER. *CALL SIGN WILL CORRESPOND WITH NAME OF LANDING SITE IF RESERVE IS COMMITTED.
N/A	TULLY	N/A	N/A	G/A RTO, STANDBY RESERVE	37.30*		
N/A	MURRAY	N/A	N/A	PFOR, STANOBY RESERVE	N/A		
N/A	BOYETTE	N/A	N/A	R & R			

SUPPORTED UNIT: 1-188TH INF.
LIFT UNIT: A/21ST AVN BN
ACL: 8 PAX
LZ TIME: 31 0600 MAR
DAGO: 53 AIR, 1-188TH INF, DEKKAR STRIP

TYPE ACFT: UH-1D
ARTY PREP AT LZ MACON & ALBANY COMMENCES
H-20 MIN; LIFTED H-S MIN
ARTY PREP FIRED FROM GL 035725
CCP: GL 956696
RP: GL 015692

SIGNAL
1-188TH INF: RIGHT HALF, 47.00
A/21ST AVN BN: DEADLY SERPENT, 39.00
PATHFINDERS: DEKKAR CONTROL, 34.50
ALBANY CONTROL, 40.20
MACON CONTROL, 51.30
RESERVE, 37.30

(CLASSIFICATION)

Figure 14. Operation planning format.

Page 57, appendix E, paragraph 6a(1). Line 1 is changed to read, "(1) *Left traffic pattern.* The aircraft".

Page 57, appendix E, paragraph, 6a(2). Line 1 is changed to read, (e) *Right Traffic Pattern.* The air-".

Page 58, appendix E, figure 17. In figure 17 the traffic pattern designations are changed to read, "LEFT TRAFFIC PATTERN (STANDARD)," and "RIGHT TRAFFIC PATTERN".

Page 66, appendix F, figure 29. Line 4 of the

figure caption is changed to read, "*directly under helicopter.* Signaller must remain in full".

Page 70, appendix F, figure 34. Line 2 of the figure caption is changed to read, "Point to the left wheel, left arm repeatedly moved upward *above the shoulder.*" "Backward" is deleted.

Page 70, appendix F, figure 35. Line 2 of the figure caption is changed to read, "point to right wheel, right arm repeatedly moved upward *above the shoulder.*" "backward" is deleted.

APPENDIX J

(Added)

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Agreed English/French texts

STANAG 3597

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT (STANAG)

HELICOPTER TACTICAL OR NON-PERMANENT LANDING SITES

Annex: A. Helicopter Landing Points

RELATED DOCUMENT: ACP 136(B) COMMUNICATIONS IN-
STRUCTIONS PANEL SIGNALLING

OBJECT

1. The aim of this agreement is to establish selection criteria and systems of marking helicopter landing sites for day and night operations.

AGREEMENT

2. Participating nations agree to utilize the selection criteria and systems of marking helicopter landing sites for day and night operations prescribed in the ensuing paragraphs. This STANAG gives the ideal criteria. At times it may be necessary to accept reduced criteria, however the ultimate decision will rest with the helicopter unit. The dimensions may require alteration in the future as further new types of helicopters are introduced.

3. To enable a safe landing to be made, it is essential that solid obstacles, inflammable, and loose material are cleared. The term "cleared to ground level" is used to indicate this. It would not, for instance, be necessary to clear grass up to one foot (0.3 metre) high which might cover a level field unless a fire risk existed. The centre of the landing point where the helicopter lands must be solid enough to bear its weight, the term "Hard Surface" is used to indicate this.

4. If ground obstructions cannot be cleared, some helicopter operations can be done without the helicopter actually landing. The same dimensions of clearing and ground markings are required, and the helicopter will hover above ground obstructions which prevent it landing. Every

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effort should be made by ground troops to improve the Landing Point Surfaces to enable the aircraft to land.

*DAY OPERATIONS (VISUAL APPROACHES)**CRITERIA FOR LANDING SITES*

5. *Dimensions.* The size of the landing site will depend on the number of landing points within it, and the size of these Landing Points. The criteria, as provided in figures 1, 2 and 3 of Annex A represent guidance on the preparation of these Landing Points. Helicopter units will designate the size, small, medium or large, to be utilized by their units for specific operations. Numerous considerations such as helicopter type, unit proficiency, nature of loads, and climatological conditions may apply to size of Landing Points utilized. Recommended distance between Landing Points within a Landing Site are as follows:

- a. Small Landing Points: 80 ft. (25 metres)
- b. Medium Landing Points: 115 ft. (35 metres)
- c. Large Landing Points: 165 ft. (50 metres)

NOTE: Measured from centre to centre.

6. *Approaches.* Ideally there should be obstruction-free approach and exit paths into the prevailing wind; in conditions of light wind a single approach/exit is acceptable. The normal maximum obstruction angle, measured from the outer edge of the central cleared area, should be 6° or 1 in 10 (See Annex A, fig. 69). However, greater obstruction angles may be acceptable, but this must be confirmed by the helicopter unit.

7. The surface of the center of the Landing Point must be even and sufficiently firm to allow a fully loaded vehicle (1/4 ton for light helicopters; 3 tons for larger helicopters) to stop and start without sinking. The whole LP must be cleared of any loose material or piles of dust/sand which could be blown up by the rotors of the helicopter. LPs with sandy or dusty surfaces should be stabilized or covered by an agreed method. Any snow on any LP should be packed or removed to reveal any hazardous objects and reduce the proportion of blowing snow; a marker is essential to provide a visual reference for depth perception and also to reduce the effect of white-out.

8. *Slope of Ground.* The ground should be relatively level and the slope should not exceed 7° (1 in 8) if the helicopter is to land. However, at the pilot's discretion it may be possible for a helicopter to hover just in contact with the ground on slopes greater than 7° (1 in 8).

9. *Concealment.* A Landing Site in close proximity to forward troops should be below the line of sight of enemy ground observation with, where possible, an approach/exit route giving similar cover.

10. *Marking of Landing Sites and Landing Points.* Landing sites and points should be marked when circumstances allow. Panels and other

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markers indicated in ACP 136(B) are to be firmly secured or removed before the helicopter hovers so they do not blow into the helicopter rotors or engine intakes. Markings should be kept to a minimum and only displayed when actually required in order not to disclose positions to the enemy.

11. *Identification of Landing Sites.* The identification of landing sites may be effected by one of the following methods:

- a. Carbide inflated yellow marker balloons (which must be lowered once the helicopters have acknowledged recognition).
- 11. b. Coloured smoke, flashing lights or pyrotechnics. To prevent deception by the enemy following identification sequence should be used.
 - (1) Ground unit releases smoke etc. on request.
 - (2) Helicopter pilot states the colour he has seen.
 - (3) Ground unit confirms colour is correct.
- c. By the use of a pre-arranged display of figures or letters.

12. Landing Zones are designated by colour or codeword and Landing Site by Landing Zone colour or codeword/prefix and number. Where unit Landing Zones are larger, the numbering of Landing Sites can be zones by geographical or sub-unit areas. Thus the Landing Site in one company area may be known as RED 30, RED 31, RED 32, RED 321, RED 322 etc. and in another company area the Landing Site may be designated RED 40, RED 41 etc.

13. *Radio Aids.* Whenever possible radio communication and electronic aids, including Air Traffic Control facilities should be located at a landing site.

NIGHT OPERATIONS

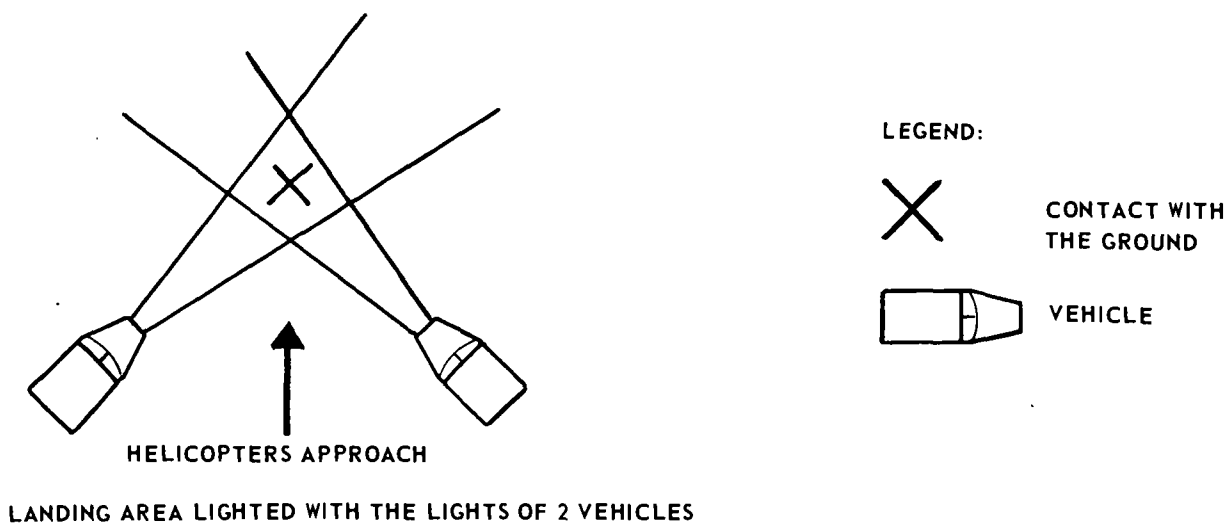
14. *Selection and Marking of Night Landing Sites.* The criteria for the selection and marking of night landing sites varies according to national doctrine. A thorough briefing will be necessary before a night operation is mounted.

15. *Emergency Night Landing Point Lighting*

- a. An example of an emergency night lighting system is shown below.
- b. Two low silhouette vehicles are placed approximately 115 feet (35 metres) apart and 115 feet (35 metres) down wind of the centre of the Landing Point with their headlight beams intersecting at the centre of the Landing Point. The helicopter will approach into wind and pass between the vehicles and land in the pool of light.

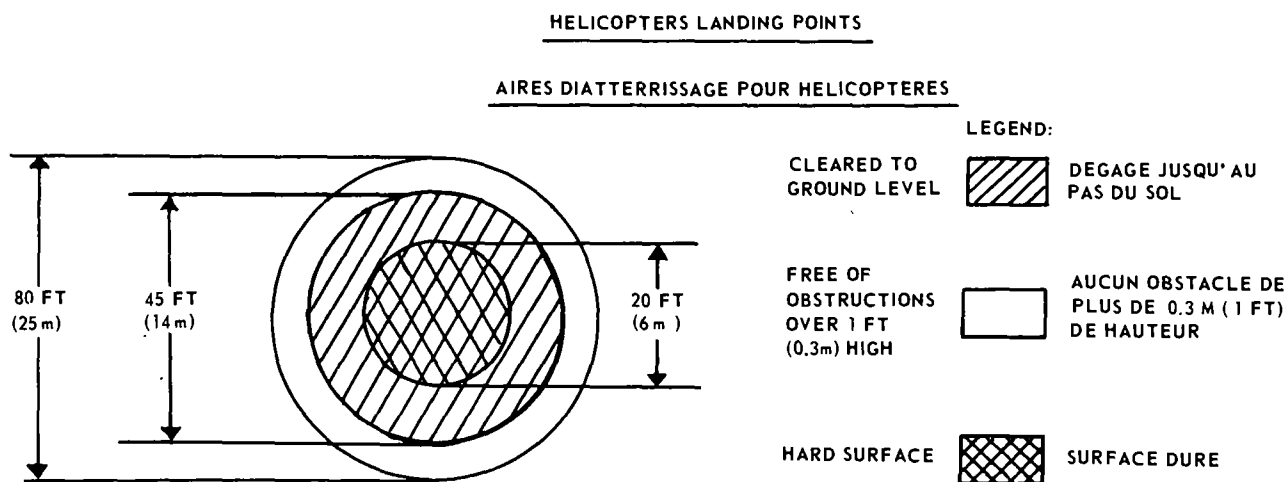
NOTE: The method is not suitable for large helicopters.

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NATO UNCLASSIFIED*Figure 65. STANAG 3597.***IMPLEMENTATION OF THE AGREEMENT**

16. This STANAG is considered to be implemented when a nation has issued the necessary orders/instructions to the forces concerned putting the procedures detailed in this agreement into effect.

**ANNEX A TO/ANNEXE A AU
STANAG 3597**

*Figure 66. Small landing point/Aire D'Atterrissage De Petites dimensions.*NATO UNCLASSIFIED

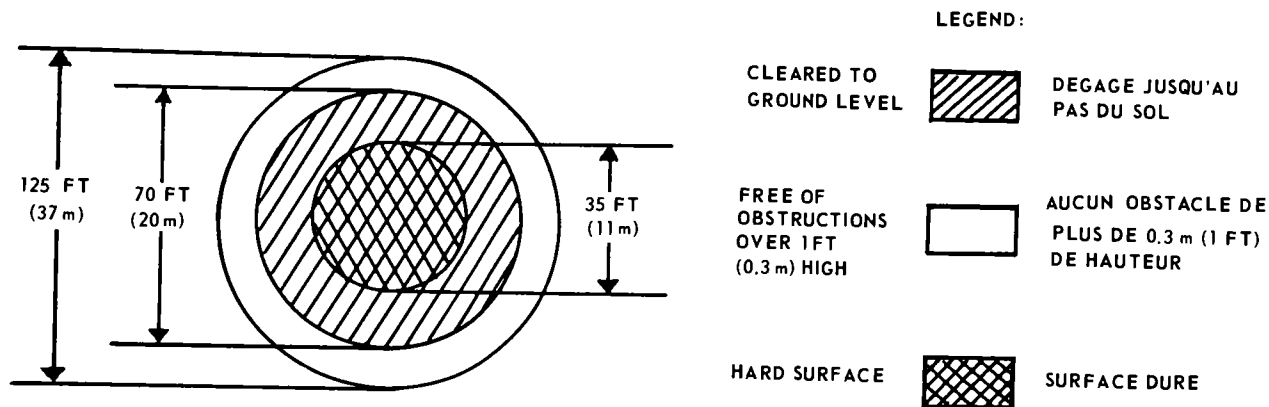
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Figure 67. Medium landing point/Aire D'Atterrissage De Moyennes dimensions.

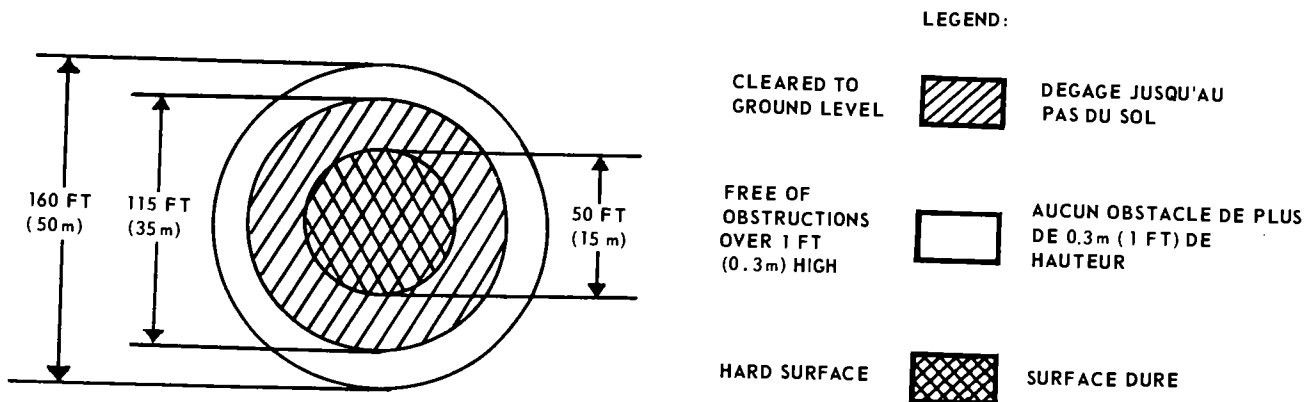


Figure 68. Large landing point/Aire D'Atterrissage De Grandes dimensions.

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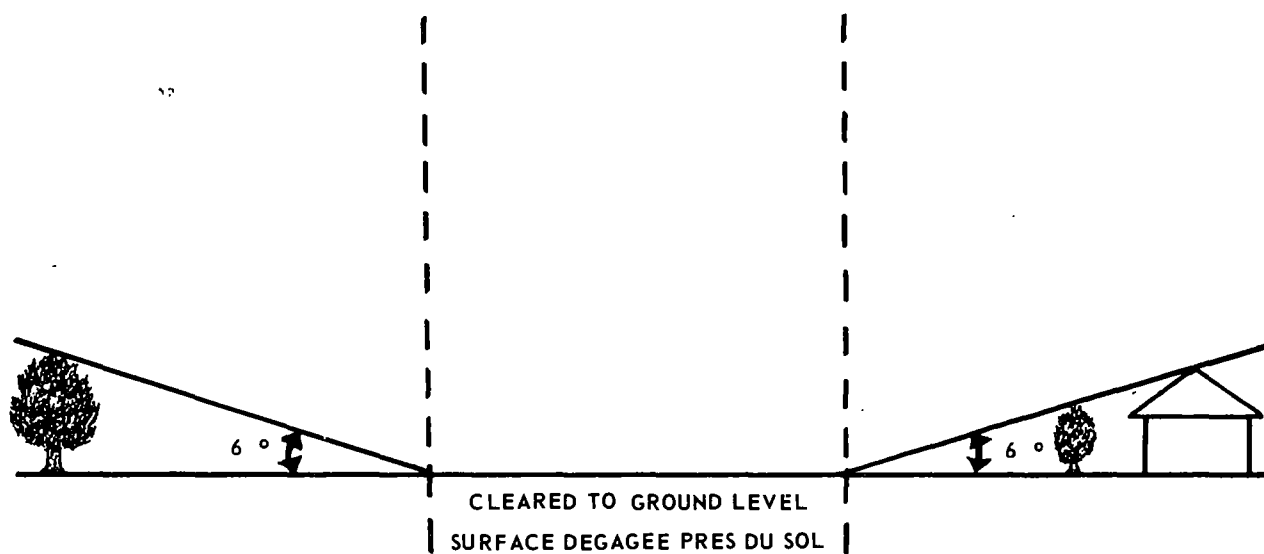
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Figure 69. Landing point obstruction angle/Angle De Pente Des obstacles D'Une Aire D'Atterrissage.

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APPENDIX K

(ADDED)

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Original English/French Translation.

STANAG 3570*

NAVY/ARMY/AIR

DETAILS OF AGREEMENT (DofA)

DROP ZONES AND ULLA DROP ZONES-CRITERIA AND MARKINGS

Annexes: A(DofA). Selection and Dimensions for Personnel/Cargo Drop Zones.

B(DofA). ULLA Drop Zone Markings.

C(DofA). Personnel/Cargo Drop Zone Markings.

AGREEMENT

1. Participants agree to the criteria stated herein for selection and methods for marking Drop Zones and ULLA Drop Zones during Tactical Air Transport Operations and to employ the methods described for:

- a. Selecting suitable drop zones.
- b. Providing guidance for aircraft.
- c. Marking drop zones.

NOTE: This STANAG does not necessarily apply to the selection dimensions, marking and criteria for Special Forces Drop Zones.

2. *General.* In selecting the area to be used as a drop zone, consideration must be given to the type of operation, urgency of the mission, safe delivery of personnel and cargo, natural and man-made hazards and obstructions, safety of flight, and aircraft operational limitations.

3. *Technical Characteristics.* The technical characteristics of drop zones fall into two categories:

- a. Characteristics common to all drop zones, governed by the requirements of air transport.
- b. Characteristics peculiar to each type of drop zone, according to whether it is for:
 - (1) Dropping of personnel/parachutists.
 - (2) Dropping of equipment and supplies.
 - (3) ULLA.

*NOTE: Reference Air Standardization Agreement (AIR-STD) 44/13C, 29 August 1969

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4. *Air Transport Requirements.* Air transport requirements valid for all drop zones are:

- a. Ease of identification.
- b. Lines of flight approximately parallel to neighbouring zones.
- c. Headings to be chosen so as to avoid glare.
- d. Ease and safety of approach and departure.

5. *Physical Characteristics.* Peculiar physical characteristics which apply to each type of drop zone are:

a. *Personnel drop zones.*

- (1) *Surface.* A flat, resilient surface without obstructions is technically the most acceptable for a troop drop zone.
- (2) *Gradient.* The gradient of the ground may be up to 30% depending on the strength of the wind. Where the gradient is greater than 15%, the line of drop should preferably be at right angles to the line of greatest slope, so that landing may take place around the same contour line. The dropping height is calculated in relation to the highest point of the zone.
- (3) *Obstacle.* Obstacles preventing the use of a zone are: built up areas, high tension electric lines, cliffs, ravines and normally, rivers and lakes. However, jumps on lakes or the sea can be carried out by specially equipped personnel.
- (4) *Other areas.* If considered operationally necessary para-drops may be made in wooded or forest areas, mountains or lakes.

b. *Cargo Drop Zones.* The required characteristics are similar to those for personnel drop zones. Moreover, they should be accessible to vehicles or, at least crossed by paths, to simplify the collection of the equipment and supplies. Dropping over water should only be considered in very special circumstances.

c. *ULLA Drop Zones.* During ULLA operations the aircraft fly in close proximity to the ground. As the loads exit the aircraft at high velocity, they are subjected to high deceleration forces during the impact with the ground and slide to a stop. Stringent criteria for surface roughness and obstructions must be established to prevent damage to aircraft or loads. Details of these criteria will be at Annex D(DofA) when published.

6. *Dimensional Criteria for Selection of Drop Zones.* Factors which bear on the determination of dimension criteria for drop zones are height of the aircraft above ground level (AGL), and indicated air-speed of aircraft in knots (KIAS), number of aircraft in formation, number of troops or loads to exit the aircraft, time interval between troops or between loads, type of parachute employed, visual or non-visual guidance

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of aircraft and in the latter case, method of alignment, wind drift effect and required probability of success.

7. *Guidance of Aircraft.* Special detachments may be posted in advance at drop zones in order to assist in guiding the aircraft. To this end, they set up:

- a. As a priority a ground-air radio to provide a link between themselves and the aircraft.
- b. A radio/electronic beacon of the type described in paragraph 8.d., below.
- c. Visual guidance facilities such as panels, lights, smoke pots, flares and flashing lamps.

8. *Signalling Devices.*

- a. *Panels.* Standard Ground to Air recognition panels normally used by the different NATO forces or the best available substitute such as Canvas strips, cloth material etc., will be used to mark these zones during daylight operations. Panels should contrast with the surrounding terrain. The markings should normally be visible under Visual Meteorological Conditions (VMC)/Visual Flight Rules (VFR) at a distance of not less than three nautical miles (5.5 kilometres) from a height of 1,500 feet (450 metres) above ground level.
- b. *Lights.* During darkness the zones will be marked by lights. These lights should consist of fires, flares or lamps which should normally be seen at the same distance and from the same height as the panels. The lights should not be so bright as to attract the attention of the enemy and should be easy to extinguish or cover. The intensity of the lights should not interfere with or degrade the pilot's night vision. As far as possible they should be visible only from the direction of the approach path of the transport aircraft. For special mission, special lighting would be detailed in the operation instructions.
- c. Smoke may be used to give an indication of wind direction and speed if this is considered necessary, and should be placed downwind of the drop zone symbols in order to preclude those symbols being obscured.
- d. *Radio/Electronic Beacons.* Non-visual drops are affected by means of radio/electronic beacons and devices positioned on the drop zone or at a known position adjacent to the drop zone. The crew of the aircraft using aircraft electronic equipment home on the beacon and receive guidance to the drop zone. Certain types of devices use interrogator/responder systems by which the aircraft queries the beacon and the beacon transmits data to the aircraft giving direction and distance to this drop zone.

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9. *Method of Marking.* Identification of a drop zone is accomplished by display of a code identifier letter selected from the following group: A(ALPHA), C(CHARLIE), J(JULIET), R(ROMEO), S(SIER-RA), or V(VICTOR). When multiple drop zones (or drop zones and landing zones) are used in an operation each should be marked with a different code identifier. When using a drop zone with one point of impact for troops and another point of impact for cargo, each point of impact is to be marked with a different code identifier. Code identifiers should be assigned in the operations instructions and/or agreed at the mission planning briefing. Minimum acceptable size of letters and symbols for drop zone markings is 20 feet (6.1 metres) by 20 feet (6.1 metres); the most desirable size is 45 feet (13.7 metres) by 45 feet (13.7 metres).

a. *Personnel/cargo drop zones. (See Annex C)*

(1) *Minimum acceptable markings.*

- (a) Place the identifier code letter(s) on the intended point(s) of impact for personnel/cargo with the base of the letter nearest the approach end of the drop zone and parallel to the drop zone axis. Panels are used to form the letter(s) for day operations and lights for night operations.
- (b) To indicate a temporary closing of the drop zone, go-around procedure for aircraft, or temporary postponement of airdrop, place two parallel bars symbol at the base of the identifier letter with the bars parallel to the drop zone axis. Use panels or lights, as appropriate, to form the symbol. Size should be the same as the identifier letter.
- (c) An emergency "no-drop" condition or closing of the drop zone is indicated in one of two ways: placing an "X" symbol at the base of the identifier letter, or by using red smoke/flares/lights.

(2) *Additional markings.* When the special detachment or team responsible for marking the drop zone has the required marking materials and adequate time for installation, the markings listed below are desirable and enhance visual communications between the drop zone team personnel and the aircrews.

- (a) *Timing Points.* The purpose of timing points is to identify a point of known distance from the intended point of impact at which the aircrew can commence a time count to the Computed Air Release Point (CARP). During day operations the timing point will be selected by the aircrew from prominent terrain or topographical features. Artificial timing points may be used when natural ones are not available. At night, each timing marker point may consist of a green flashing or rotating

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beacon and a white stationary vertical beam light clearly visible at drop altitude from a distance of three miles.

- (b) *Ground Release Point.* When directed in the operation order or instruction and/or agreed in the mission briefing, the arrow symbol may be used to mark the release point on the ground over which the aircrew should release the first parachutist or cargo load so as to strike the intended point of impact. Positioning of the ground release point is determined by the drop zone marking detachment or control team by computation of the anticipated trajectory of the parachute supported person or object. The arrow symbol should be constructed so that the tail is twice the length of either arm, with each arm forming a 45° angle with the tail.
 - (c) *Smoke.* Smoke, other than red, may be used as a visual indication of wind direction and speed. They should be located adjacent to the identifier code letter so that the smoke does not obscure any drop zone markings from the aircraft crew.
 - (d) *Colour Indicators.* Smoke, pyrotechniques or lights may be used to indicate a drop zone condition or to pass late changes in that condition prior to the adjustment of ground panel or light markings. Their availability and use must be specified in appropriate operation orders or instructions. The use of red smoke, red flares or red flashing lights will indicate a no-drop condition.
 - (e) *Limit Markers.* Panels or lights, as appropriate may be used to mark the corners and outline the perimeter of the drop zone when security of the area permits. The trailing edge or departure end of the drop zone may be marked at night with an amber rotating or flashing beacon and may be co-located with a vertical stationary beam light placed on the drop zone axis.
- (3) The above visual markings may be augmented by radio communications instruments when communication security permits.
- b. *ULLA System Drop Zones.* This system uses the drag of an extraction parachute(s) to extract the load from the aircraft while the aircraft flies low across the drop zone. After extraction and impact of the load the parachute(s) continues to augment the friction during the ground slide. The extraction process is activated as the aircraft passes over the approach end of the impact area. Markings must

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indicate the initial point at which the extraction process can be safely activated and the point at which the aircraft must initiate climb out from the drop zone (See Annex B).

(1) *Day Markings*

- (a) *Code Identifier*. A code identifier letter formed with panels and placed at the approach end of the impact area and on the centre line.
- (b) *Approach Panels*. Four panels, two on each side of the centre line at the approach end of the impact area, starting 50 feet (15.5 metres) from the centre line extending outwards and spaced 6 feet (2 metres) apart. The panels are mounted vertical to the ground and perpendicular to the drop zone axis.
- (c) *Release Panels*. Two panels one on each side at the centre line may be positioned prior to the impact area to mark the release point.
- (d) *Climb Out Panels*. Climb out panels placed on the trailing (departure) end of the impact area, 50 feet (15.5 metres) on each side of the centre line, mounted vertical to the ground and perpendicular to the drop zone axis.

(2) *Night Markings*

- (a) *Code Identifier*. A code identifier letter formed with white lights and placed at the approach end of the impact area and on the centre line.
 - (b) *Approach Lights*. The approach end of the impact area marked with six green lights, three on each side, and placed at 50 feet (15.5 metres) from the centre line extending outwards and spaced 6 feet (2 metres) apart.
 - (c) *Boundary Lights*. Amber Lights, used to give visual orientation and boundary reference to the pilot, placed at 300 feet (93 metres) intervals, from the approach end of the aircraft area and 50 feet (15.5 metres) on each side of the centre line.
 - (d) *Release Lights*. Lights placed prior to the impact area may be used to mark the release area.
 - (e) *Climb Out Lights*. Red lights are substituted for panels to mark the climb out.
- c. *Special Cases*. Where the nature of the terrain, area of operations and air drop system used preclude the layout and marking of personnel/cargo drop zones as prescribed above, the devices used and methods of markings are to be decided jointly between the commanders of the air transport force and supported force, and the use of such layout and markings is to be provided for in the operation order or instruction.

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IMPLEMENTATION OF THE AGREEMENT

10. This agreement will be considered to have been implemented when the provisions of the Details of Agreement (para 1 to C (DofA)-1) have been included in the appropriate National Standing Orders, Manuals, or Instructions.

*ANNEX A TO THE DETAILS OF AGREEMENT
OF STANAG 3570*

*SELECTION AND DIMENSIONS FOR PERSONNEL/CARGO DROP
ZONES*

1. *Selection of Drop Zones.* When selecting a drop zone, consideration must be given to the size of the landing area required for the type and number of troops and/or equipment to be dropped in one run across the drop zone, and associated with the variable factors applicable to the aircraft performance (including the air drop system in the aircraft) the weather conditions, the aircrew capabilities, and the performance of the air dropped items. These factors can then be used to determine the probability of success of the proposed mission on a known area, or the area required to achieve a stated probability of success requirement. These factors are:

- a. The aiming accuracy at release.
- b. The scatter factor for multiple ejection/extraction.
- c. The stick length.
- d. The wind effects during the drop.
- e. The drift in distance per unit of windspeed.
- f. The forward throw prior to balanced suspension.
- g. The ground area available, or required.

2. *Dimensions of Drop Zones.* Dimensions of drop zones will be calculated using national procedures. When multi-national forces are jointly involved, the drop zone dimensions will be calculated using the national procedure of the Air Transported Force.

A(DofA)-1

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ANNEX B TO DETAILS OF AGREEMENT
OF STANAG 3570

ULLA DROP ZONE MARKINGS
(DIAGRAMATIC)

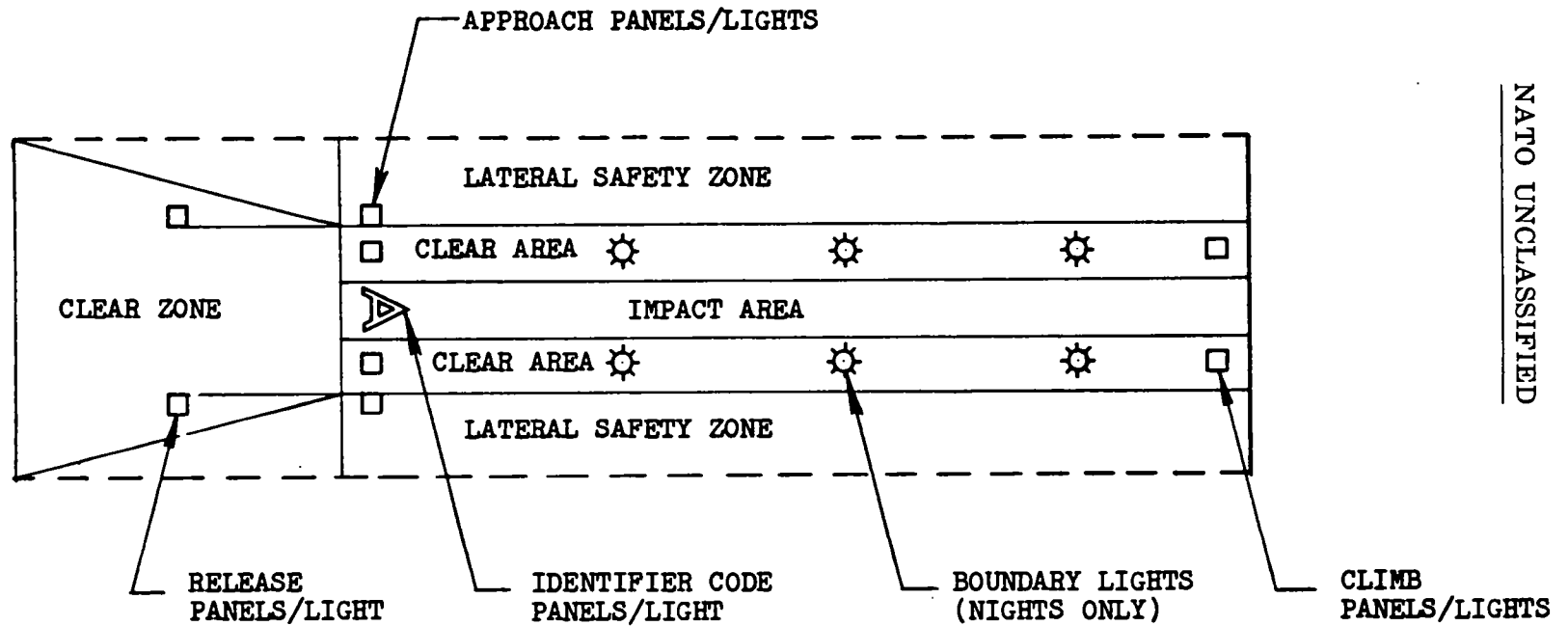
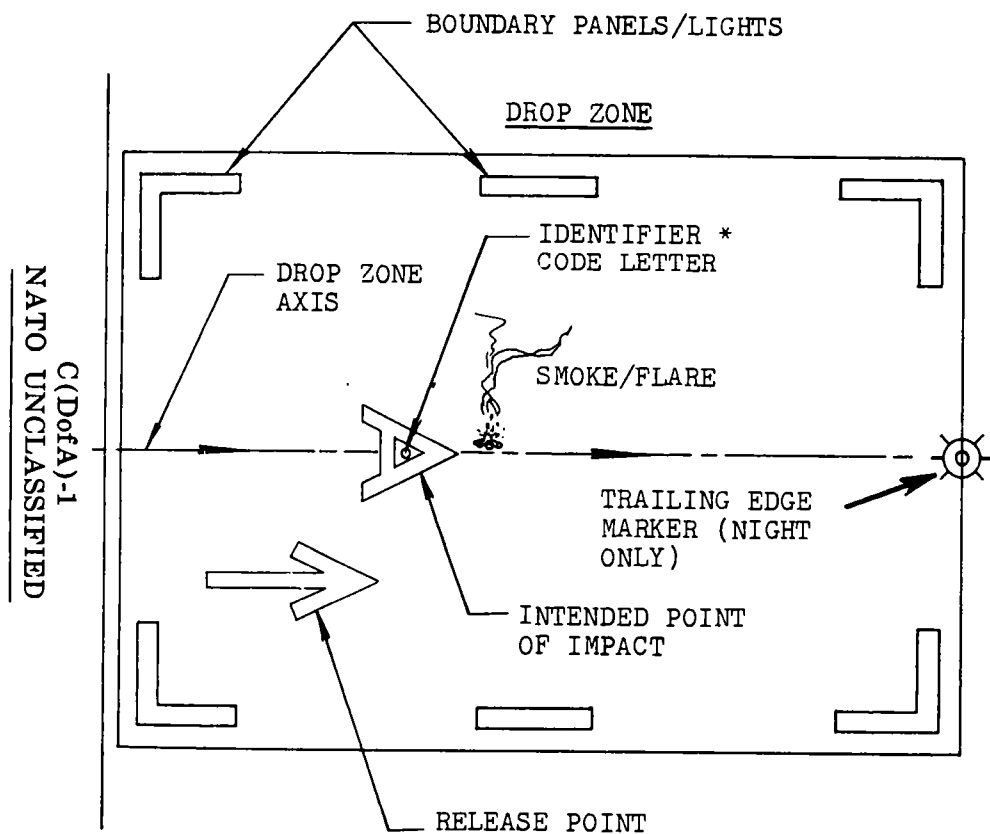


Figure 70. ULLA drop zone markings (diagramatic).

TROOP/CARGO DROP ZONE MARKINGS
(DIAGRAMATIC)

LEGEND: * MANDATORY

TYPE OF MARKING	(PANELS)	NIGHT (LIGHTS)
IDENTIFIER CODE* (A,C,J,R,S)	A	△
IDENTIFIER CODE USING HORIZONTAL BARS WITH CODE LETTER	A	=
TEMPORARY CLOSING * OF DZ	A	△
EMERGENCY * "NO-DROP"	A	△
TIMING POINT MARKERS (NIGHT)		☼

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Figure 71. Troop/cargo drop zone markings (diagrammatic).

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

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The Adjutant General

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FIELD MANUAL

No. 57-38

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 9 October 1968

PATHFINDER OPERATIONS

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CHAPTER 1

INTRODUCTION

1. Purpose and Scope

a. This manual is designed to provide a ready reference on the organization, the training, and the employment of TOE pathfinder units and unit terminal guidance personnel.

b. The material contained in this manual is applicable to both nuclear and nonnuclear warfare.

c. This manual describes the procedures used by pathfinder units during various types of operations. Terminal guidance personnel may also use these procedures. The fact that ground units do not have supporting TOE pathfinder units does not affect the basic guidance procedure. The manual must be used in conjunction with FMs 1-5, 1-105, 7-11, 7-15, 7-20, 7-30, 21-60, 57-35, and 61-100.

d. The tactics, techniques, and procedures described for the conduct of various types of missions are not inflexible rules, but are guides which can be modified as varying conditions of airmobile operations may require.

e. This manual contains a glossary of terms and definitions peculiar to airmobile and pathfinder operations and air traffic control. Users of the manual are urged to read and refer to this glossary as an aid to understanding the text.

f. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to the Commandant, United States Army Infantry School, Fort Benning, Georgia 31905.

2. Missions

a. The primary mission of Army pathfinder units is to provide navigational assistance and control of Army aircraft in areas designated by supported unit commanders.

b. Secondary missions for pathfinder units include—

(1) Providing limited advice and physical assistance to lifted units in the planning of airmobile operations.

(2) Preparing and positioning personnel and loads for air movement.

3. Capabilities

a. Pathfinder units have the following capabilities:

(1) Conducting reconnaissance for and selecting landing or drop zones for Army aircraft in areas which have been selected by supported unit commanders.

(2) Moving to areas of operation by foot, water or surface vehicles, aircraft or parachute.

(3) Preparing landing or drop zones to include establishing and operating visual and electronic navigational aids and removing minor obstacles.

(4) Furnishing ground-to-air voice radio communications to aircraft for the purpose of providing information, guidance, and air traffic control within the area of operation.

(5) Providing advisory service to aviators concerning friendly mortar and artillery fires through direct coordination with collocated fire support units.

(6) Assisting in the assembly of air delivered troops, supplies, and equipment.

(7) Providing advice and limited physical assistance in preparing and positioning troops, supplies, and equipment for air movement.

(8) Conducting limited CBR monitoring or surveying of designated areas.

(9) Providing limited weather observations to include wind velocity and direction, cloud cover, visibility, approximate ceiling, and density altitude.

(10) Operating, by mutual agreement with the U.S. Air Force, drop zones, and airfields for USAF aircraft in the absence of USAF combat control teams. In this situation, it may be necessary to provide pathfinders with radios (UHF or VHF) that are compatible with Air Force aircraft. Close coordination between aviators and pathfinders must be effected in order to insure complete understanding of the markings and radio communication procedure to be used.

b. Each pathfinder section is organized and equipped to establish and operate—

(1) Day or night control facilities for the simultaneous operation of four helicopter landing sites of any type. Night operation of these landing sites may be limited by the amount of lighting equipment organic or available to pathfinders. Included is the provision for one manned release point.

(2) Two day or night fixed wing airfields.

(3) Three day or night resupply or personnel drop zones.

4. Limitations

Because pathfinder units are limited in personnel and equipment resources, their employment must be restricted to aircraft guidance and other primary tasks. It is necessary that pathfinder units be augmented by additional personnel from a supported unit to—

a. Provide security.

b. Remove major obstacles.

c. Recover and assemble equipment and supplies.

d. Operate additional radio nets and telephones.

e. Transport items of equipment.

f. Conduct detailed CBR monitoring and survey.

5. Organization and Assignment

a. The basic pathfinder unit consists of 2 officers and 13 enlisted men. Each member of the unit must be a qualified parachutist and

be cross-trained in the pathfinder duties of other unit members.

b. Pathfinder units may be organic to—

(1) Field Army or separate corps (TOE 7-168E).

(2) Divisional and separate aviation battalions possessing a troop lift capability (TOE 1-76, TOE 1-56, and TOE 1-256).

(3) Aviation group of the airmobile division (TOE 1-101).

c. Depending upon its location within the Army structure, a pathfinder unit may be referred to as a platoon, section, or detachment.

6. Equipment

a. *General.* The TOE of the pathfinder unit provides equipment essential to pathfinder operations. However, additional equipment may be required when the unit is committed to its maximum capability.

b. *Navigational Aids.* Navigational aids are used to help aviators locate and identify an exact area. Electronic and visual navigational aids are the two principal types employed.

(1) *Electronic aids* include homing beacons, transponders, radios, and any other electronic device that assists in aircraft navigation. These aids have a greater range and provide more security than visual navigational aids. While radio ordinarily is considered an insecure means of signaling, it is a relatively secure means in pathfinder operations because of the time required by an enemy to obtain a direction finding (DF) fix and dispatch a force to the area. However, any electronic aid may be subject to enemy jamming.

(2) *Visual navigational aids* are used to designate specific areas or points in landing and drop zones. They are also used in transmitting ground-to-air signals. Daytime visual navigational aids include panels, smoke, and colored jackets for signalmen. Night visual aids include light beacons, glide slope indicators, lanterns, baton flashlights, and pyrotechnics. Numerous day or night field expedient visual aids may also be used effectively. Visual navigational aids provide less security in that the majority of them may be seen by the enemy.

c. *Communication Equipment.* Organic communications equipment includes the AN/PRC-25 radio and limited wire equipment, insuring

the capability of communicating with aircraft, other pathfinder elements, and supported units. A homing capability has been incorporated into the radio equipment most often encountered by pathfinders to provide additional navigational assistance.

d. Assembly Aids. Assembly aids are used to designate troop or supply assembly areas. As with navigational aids, assembly aids may be either electronic or visual. Available field expedient means may also be effectively employed.

(1) *Electronic assembly aids* include radios and homing devices employing a radio signal. They provide more security and usually greater range than visual assembly aids.

(2) *Visual assembly aids* are usually simple to employ and afford positive identification of assembly areas, but they can be seen by enemy as well as friendly troops and close coordination of their use is required in order to prevent misunderstandings. Visual assembly aids include panels, smoke, and armbands for day operations and lanterns, flashlights, light beacons, and pyrotechnics for night operations.

e. Miscellaneous Equipment. Miscellaneous pathfinder equipment includes vehicles, binoculars, small starlight scopes, nonelectronic demolition kits, wind measuring equipment, parachutes, and CBR detection equipment.

7. Training

a. Commanders of major units to which pathfinder units are assigned are responsible for pathfinder unit training and proficiency. Pathfinder training is most beneficial when it is integrated with that of aviation and ground units.

b. Pathfinders become qualified by successful completion of the Pathfinder Course, Airborne Department, United States Army Infantry School, Fort Benning, Georgia. Unqualified personnel serving in TOE pathfinder units in combat zones may become qualified under the provisions of a pertinent directive published by the appropriate major command.

c. Pathfinder unit training is carried out under the guidelines provided by ATT 7-168. In any pathfinder training program, emphasis must be placed on development of individual proficiency in air traffic control procedures and a thorough understanding of supported aviation unit SOP.

d. Terminal guidance personnel in ground units are either graduates of the Pathfinder Course or of post or unit schools which follow a program of instruction similar to that of the Pathfinder Course. Additional training in pathfinder techniques for all personnel participating in or engaged in airmobile operations is outlined in Army Subject Schedule 7-50, "Air Movement Training."

CHAPTER 2

OPERATIONS

Section I. EMPLOYMENT

8. General

a. Pathfinders are employed whenever it is necessary to provide guidance and control of Army aircraft. This employment encompasses any phase of an airmobile operation or a ground operation that requires sustained support by Army aircraft.

b. In some situations this employment may be only on a short-term, mission basis with pathfinders being extracted from a landing site or drop zone for employment elsewhere upon completion of the major lift and/or drop into the area.

c. Aviation units with sufficient pathfinder resources can best support airmobile operations by attaching pathfinder elements to ground units for the duration of an operation. Attachment may occur down to company level. During such employment, pathfinders provide air traffic control, guidance, and information on an around-the-clock basis for any type airmobile movement or resupply operation conducted by or for the ground unit and supported by any aviation unit.

d. Pathfinder units are trained and equipped to select, improve, mark, and control landing sites as required. Engineer elements in direct support of lifted ground units may assist pathfinders in improving landing sites. In most

situations, pathfinders perform two or more of the above functions simultaneously, with priority given to rapid establishment of ground-to-air radio communications.

e. A pathfinder unit must be able to perform any of the assigned pathfinder missions with a minimum of notice and preparation.

9. Secondary Employment

a. Pathfinder personnel and equipment normally remain assembled in the vicinity of, and in communication with, the supported unit command post except when performing pathfinder duties for subordinate units.

b. When the pathfinder unit has completed preparations to perform further missions, it may be employed within the command post of the supported unit to—

(1) Assist in aviation unit base airfield control.

(2) Assist in minor demolition work.

(3) Assist staff sections by performing map and aerial photo work.

(4) Augment local security by acting as interior and exterior command post guard.

c. Training and maintenance of equipment should take priority over the performance of secondary missions.

Section II. PATHFINDER PLANNING

10. General

a. This section provides guidelines to pathfinder units preparing for operations. Planning procedures for pathfinder operations will vary from the highly detailed to the very brief, depending on the type operation and the time available. However, the inherent scope and

speed of airmobile operations will, in most situations, limit pathfinder planning time and force a reliance on brief oral orders.

b. The troop leading procedures discussed in FM 7-15 are applicable to pathfinder units. Additional considerations necessary for pathfinder planning are described in this section.

11. Warning Order

Upon notification of a pending operation, the pathfinder unit commander or the senior pathfinder present must alert his personnel at the earliest practicable time. The alert is followed as soon as possible by a warning order. The warning order should include sufficient information that will permit initial preparations to be made for the operation. The order should include at least—

- a. A brief statement of the enemy and the friendly situation.
- b. The mission.
- c. Individual uniform and equipment (if not in the SOP).
- d. Equipment required and priority of work in preparing for the operation (if not in the SOP).
- e. Instructions for the issue of rations, ammunition, and special equipment (if applicable).
- f. Place, time, and uniform for receiving the operation order.

12. Initial Preparations

a. Inspection of personnel and equipment begins upon receipt of the alert or the warning order. Personnel and equipment augmentations, if required, should be accomplished at this time.

b. Equipment should normally be prepared according to the following priority:

- (1) Radios.
- (2) Navigational aids.
 - (a) Electronic.
 - (b) Visual.
- (3) Weapons and essential individual equipment.
- (4) Assembly aids.
- (5) Miscellaneous items.

c. At this time, whenever possible, the pathfinder unit commander or his representative should establish initial liaison with the supported aviation and/or ground unit.

d. As additional information is received, personnel and equipment are reorganized as necessary in order to better accomplish the mission. Time permitting, rehearsals should be conducted using all available briefing aids and terrain that most nearly resembles the operational area.

e. Security is mandatory for the success of

an operation. Therefore, personnel should be provided the minimum essential information needed to complete each phase of an operation. Individuals who have received detailed information should be isolated for security reasons. Operating situations will dictate exact security requirements.

13. Coordination

a. Commanders of ground and aviation units coordinate and preplan the details of operations which require pathfinder assistance. The pathfinder commander may be required by the aviation or the ground unit commander to make recommendations on the exact location of drop zones or landing sites, landing formations, techniques to be employed, and the time schedule to be followed. These recommendations are likely to occur during any type of operation (combat assault, reinforcement, artillery displacement, resupply or evacuation). The actual drop or landing zone is selected by the supported unit commander after considering his mission, the terrain, the friendly and the enemy situations, and the advice of the pathfinder and aviation unit commanders or their designated representatives.

b. During the preparation for an operation, aviation and ground unit commanders coordinate such matters as—

- (1) Ground tactical plan.
- (2) Designation of supported ground unit(s) and any attached aviation units.
- (3) Number and type of loads (personnel, supplies, equipment).
- (4) Number and type of aircraft available.
- (5) Time schedule.
- (6) Plan for landing and loading in the staging area.
- (7) Primary and alternate flight routes.
- (8) Location of the release point(s) (RP) and the communications checkpoint(s) (CCP).
- (9) Primary and alternate landing and/or drop zones.
- (10) Landing direction and formation.
- (11) Control procedures.
- (12) Location and marking of assembly points (if used).
- (13) Visual and electronic navigational aids.

(14) Ground-to-air control frequencies and call signs.

(15) Location and duration of preplanned artillery and/or air strikes.

(16) Procedures for requesting on call fire support (armed helicopters, artillery, and tactical air).

(17) Supported unit radio frequencies and call signs.

c. The pathfinder commander is vitally interested in all of the above information and will normally participate in all or part of the coordination. He uses this information in preparing his final plan for conduct of the operation by pathfinders. A detailed knowledge and understanding of the air movement phase of an operation is required by the pathfinder to insure that he can safely and efficiently control all aircraft in and around the drop and/or landing zones. Aviation and ground commanders must keep pathfinders informed of all changes in plans and landing sites or any emergency situations. The pathfinder commander must insure that all pathfinder activities are closely coordinated with all agencies or units involved. Necessary information must be disseminated to and thoroughly understood by all pathfinders involved in the operation.

d. Based upon coordinated plans for an operation, the pathfinder commander requests any necessary augmentation in personnel and equipment. He bases this request upon the following requirements:

(1) The mission.

(2) The planned use of personnel and/or equipment for security.

(3) The requirement to assist in the assembly of personnel, supplies, and equipment of supported units.

(4) The need for assistance in removing obstacles.

(5) CBR survey or monitoring requirements.

(6) The assistance required for transporting and operating navigational aids under pathfinder direction.

e. Personnel and equipment augmentation should be kept to an absolute minimum and must be in keeping with the transportation means to be used in delivering the pathfinder party. When reinforced, the pathfinder party remains under the complete command of the

pathfinder commander who is responsible for the functions of the entire team.

14. Joining with the Supported Unit

Pathfinders join the supported unit at the appointed time and place if they are not already colocated with or in support of the lifted unit. Joining a supported unit normally will occur in sufficient time to allow a final coordination meeting between pathfinder and aviation and lifted ground representatives. However, if pathfinders enter a landing site or drop zone ahead of the assault echelon, and have been designated to accompany and provide continuous support to a ground unit, the joining with the supported unit normally will occur after the initial phase of the air movement has been completed.

15. Final Preparations

a. The pathfinder commander issues his operation order as soon as practicable. The operation order may be issued as a series of fragmentary orders based upon available information and the necessity to disseminate it. The commander assures that individuals receive a detailed briefing of their exact duties. They should be given an opportunity to study pertinent maps, aerial photos, and terrain models of the objective area. Pathfinders, in particular, must be thoroughly briefed on the location and the operation of proposed air-delivery facilities, flight routes, flight formations, time schedules, release points, and communication checkpoints.

b. A final detailed check is made of the equipment to be used in the operation. A decision is made on the exact manner in which the equipment is to be transported into the objective area. All items of equipment are prepared for rapid displacement.

c. A final weather and operation briefing within the pathfinder element involved is held just prior to departure. Any final coordination required between the pathfinders and supported units should also be accomplished at this time.

16. Organization for Combat

a. Pathfinders are organized for combat to meet the specific requirements of the mission. In the majority of operations, three to six men

is the average size of a pathfinder element at a landing site, drop zone, or when in continuous support of an infantry battalion.

b. A pathfinder section is seldom employed as a unit at a single location. In tailoring his unit for the accomplishment of a majority of missions, the pathfinder unit commander should expect and plan for widely separated and disconnected operations by elements of his unit.

17. Delivery of Pathfinders

Pathfinders can be delivered by any of a variety of ground, sea, or air transportation means. The means most often employed is landing by helicopter.

18. Air Delivery

a. Landing by Helicopter.

(1) Landing by helicopter is more accurate and flexible than parachute delivery and can be carried out under marginal weather conditions. In certain areas, however, terrain conditions may initially preclude helicopter landings. Rappelling techniques permit trained personnel to land from helicopters hovering over unsuitable landing areas. The use of "trooper ladders" from hovering helicopters also allows personnel to be either landed or withdrawn from such areas. More personnel and equipment in a better state of operational readiness can be delivered when landing by helicopter. Use of helicopters furnishes a means of aerial radiological monitoring; rapid shifting or evacuation of pathfinders; enables non-parachutists to accompany pathfinders in a supporting role; and offers a delivery means when rain or low ceilings prohibit parachuting.

(2) When possible, a pathfinder element that is enroute to an operational area should be transported in two or more helicopters.

(3) When available, it is desirable that one helicopter remain in the vicinity of the landing area to provide pathfinders with an alternate means of transportation, observation, and communication.

b. Parachute Delivery.

(1) Parachute delivery from airplanes normally affords greater range and speed of movement than air landing by helicopter. For

short operations, helicopters may be used as jump aircraft.

(2) Depending upon wind conditions, pathfinders should compute their desired parachute release points prior to arrival in the drop area. Parachute jumps are made at the lowest practicable altitude in order to assure accuracy and security. Jump altitudes and procedures for personnel are prescribed in *standing operating procedures* for the types of aircraft involved and will vary in accordance with peacetime and wartime restrictions (TM 57-220).

(3) When parachuting into an area, pathfinders carry on their person the essential operational items of equipment that they are to employ. This technique insures maximum protection of fragile items and provides immediate access to operational equipment upon landing.

(4) Parachute entry into an area has its greatest application during nonilluminated, nonsupported night operations when secrecy is the primary consideration.

c. *Landing by Airplane.* As compared to helicopter delivery, landing by airplane gives greater range and speed of movement. The necessity for comparatively large, obstacle-free landing areas, however, limits the use of airplanes for pathfinder delivery.

19. Movement by Water

Delivery by water includes the use of any surface and underwater craft. When landing from the sea, this means of delivery is considered the most secure up to the point of debarkation from the parent craft. Small boats may also be used on inland waterways in certain situations. Movement from the landing point to final destination is accomplished by land infiltration.

20. Overland Movement and Stay-Behind

a. *Overland Movement.* Infiltration by land is generally the least desirable means of delivery and is usually limited to short movements by small elements. Land infiltration is best accomplished under conditions of limited visibility over difficult terrain, and when the enemy's lines are overextended, the combat zone fluid, or portions of his boundaries are inadequately secured. Conversely, a well-

organized, stable, and closely knit defense in depth may prohibit land infiltration. When sufficient time is available, overland movement to an objective may be used in conjunction with parachute or air-landed infiltration to enhance security of an operation.

b. *Stay Behind.* Stay-behind involves prepositioning pathfinder elements within a proposed operational area while a friendly force withdraws from the area. Stay-behind operations may be considered when the enemy has the capability of over-running friendly areas and an airmobile attack has been planned to reoccupy the area; or as a deceptive measure to lure enemy forces into a position where they are vulnerable.

21. Conduct of Operations

a. *General.* Pathfinder trained personnel are capable of providing air traffic control and navigational assistance within designated landing or drop zones for airplanes and helicopters or a mixture of both. They also can perform limited physical improvement and CBR monitoring and/or survey in such areas. The degree of support which pathfinder units can provide is dictated by the availability of pathfinders, the tactical plan, the complexity of the operation, the terrain, and the state of airmobile proficiency of the supported ground unit. In any airmobile operation, however, positive aircraft control is essential.

b. *Helicopter Operations.*

(1) *Daylight assault.* During daylight airmobile assault operations, pathfinders should accompany the initial assault elements into a landing zone. Air traffic control and other pathfinder assistance is then provided to all subsequent lifts of troops, supplies, and equipment. If pathfinders precede assault elements, the time may vary from a minimum of 3 to 5 minutes to several hours, depending upon the situation. The tactical plan, to include pre-strikes in and around the landing zone by artillery, Air Force aircraft, or armed helicopters, will dictate this time, or preclude the early entry of pathfinders altogether. Normally, pathfinders will not be inserted into a landing zone prior to the initial assault echelon in daylight operations, unless the proposed landing zone requires extensive improvement or unusual control problems are anticipated.

(2) *Night assault.*

(a) *Nonilluminated.* Nonilluminated night helicopter assault operations are normally conducted when secrecy is the major tactical consideration. During such operations, pathfinders should be delivered ahead of the main body in order to insure adequate time for reconnaissance and marking of the landing site. The amount of time by which pathfinders will precede the assault echelon will be dictated by the type and extent of prestrikes, if any, the size of the operation, navigational difficulties anticipated, and the requirement for improvement of the landing site. Personnel from the supported ground unit and/or engineers may accompany pathfinders to provide security and to assist in clearing obstacles. This assistance frees pathfinder personnel to reconnoiter the landing site, install visual and electronic aids, and establish air traffic control. The method of delivering pathfinders at night will be determined by security and operational requirements. They may move across country on foot, be parachuted onto or near objective areas, be air landed in total blackout, or air landed with minimum illumination. The last method is often the most accurate and desirable from a pathfinder viewpoint, since it permits a hasty visual reconnaissance of the landing site, and thereby reduces the time by which pathfinders must precede the main body.

(b) *Illuminated.* Night airmobile operations may also be carried out under total illumination by flares or other artificial means. In this situation, the tactical plan will dictate whether pathfinders accompany the initial assault echelon, as in day operations, or precede the main body by a minimum amount of time. In either case, it is desirable that pathfinder lighting be used to identify obstacles and specific touchdown-points for individual aircraft within formations.

(3) *Withdrawal (Extraction).* It is desirable to employ pathfinders during all airmobile withdrawal (extraction, pickup) operations, both day and night. Preplanned artillery fires and/or airstrikes, as well as the maintenance of ground security to the last possible moment, make it essential that positive control of supporting aircraft exists throughout the operation. As the ground force reduces in size at a landing site, its vulnerability to attack increases. Operations must be

carefully planned and aircraft closely controlled to insure that they land at desired points in the extraction site within ground security, thus enhancing the expeditious and safe flow of personnel, equipment, and aircraft from the area. If not already present on the ground with the lifted unit, pathfinders should arrive at the extraction site in sufficient time to insure a thorough reconnaissance of the area and effective coordination with the lifted unit.

(4) *Staging areas.* Pathfinders can be employed in staging areas to provide air traffic control in the absence of air traffic control units. They may also act as liaison between the aviation and ground units and assist the ground unit commander in preparing and positioning of troops, supplies, and equipment for air movement. When a temporary staging area is established to support an operation of short duration, pathfinders should be present in the area far enough in advance of the operation to insure complete reconnaissance, marking, coordination, and establishment of positive air traffic control. Positive air traffic control in staging areas is essential to insure safe, efficient, and expeditious movement of the large numbers of helicopters and airplanes that can be expected in and around such areas. This need for control increases when the weather deteriorates, the number and types of aircraft increases, and changes in the situation or plans occur (para 30 and 37).

(5) *Artillery displacement.* Pathfinders should be employed to facilitate the rapid and safe displacement of artillery, both day and night. Thorough coordination with the artillery unit commander or liaison officer and a complete understanding of ground and aviation unit SOP is essential to insure accurate and efficient delivery of equipment, personnel, and ammunition (para 31).

(6) *Support of ground operations.* Pathfinder personnel may be attached to ground units to provide around-the-clock assistance and control of aircraft during operations requiring sustained Army aviation support. Pathfinders attached to infantry battalions may be further attached to companies to provide such support, consistent with availability of personnel and equipment. Such continuous support greatly enhances overall operation efficiency and aviation safety during all types of

airmobile operations. However, this type of support cannot be habitually provided by aviation units possessing only limited pathfinder resources. In such cases, pathfinders are normally employed on a short-term, priority basis wherever they can best assist in the accomplishment of overall major unit missions. In the absence of pathfinders, selected personnel within ground units must be trained and prepared to provide minimum required assistance to supporting aircraft.

(7) *Drop zones and airplane landing zones.* Pathfinders may also be employed to operate resupply or personnel drop zones and airplane landing strips, both day and night. In the absence of USAF Combat Control Teams, and by joint agreement, Army pathfinders may provide control for USAF aircraft in both drop and landing zones. However, it may be necessary to provide pathfinders with communications equipment (UHF and VHF) that is compatible with these aircraft.

(8) *Mixed operations.* Situations will often exist that require provisions for and simultaneous control of mixed operations at the same location; that is, resupply parachute drops into forward helicopter landing sites. As a rule, helicopter traffic can be expected at all fixing wing airfields. Mixed air traffic often presents difficult control problems and strict control measures must be applied. Landing, parking, loading, unloading, refueling and rearming areas must be designated, coordinated, and clearly identified to insure smooth operations.

22. Communications

a. An essential element of a successful pathfinder operation is communications by ground-to-air voice radio. This radio should be the first item placed in operation at a landing site or drop zone and should be the last item taken out of operation. Pathfinders must have a thorough understanding of voice radio procedures, to include phraseology unique to air traffic control (app E). Communications must be clear, concise, applicable, accurate, and correctly timed. To achieve the necessary speed and clarity of transmission, radio discipline must be practiced by pathfinders and aviators. Extraneous and unnecessary messages must be omitted. Pathfinder air traffic control frequen-

LANDING ZONE

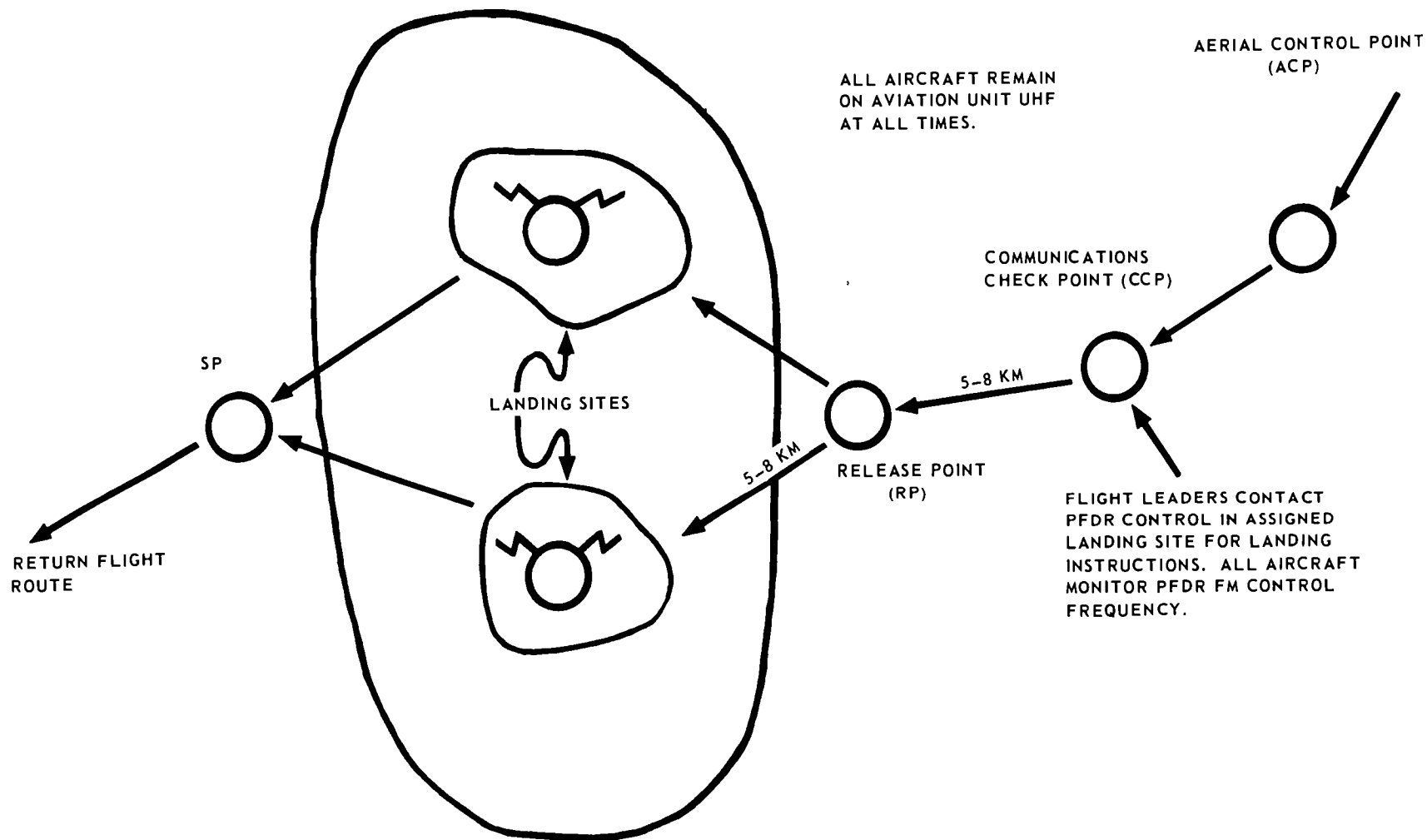


Figure 1. Enroute communications procedures with pathfinders in landing zone.

cies should be used for that purpose only, except in emergencies (fig. 1).

b. Because of the amount of vital information exchanged, the copilots of aircraft normally record the important portions of ground-to-air messages to insure that proper instructions are understood and followed. For examples of ground-to-air message transmissions, see paragraphs 30b, 37b, and 44b.

c. Pathfinders use electronic homing beacons, visual aids, and arm-and-hand signals to complement voice communications. Aviators and transported troops must understand the purpose and meaning of the aids displayed and the techniques employed. A discussion of the aids used is found in paragraph 6. A discussion of arm-and-hand signals and visual aids is found in FM 21-60 and appendix F.

d. Whenever possible, pathfinders should monitor supported unit command radio nets in order to keep abreast of rapidly changing situations that could influence Pathfinder operations.

e. Positive communications must be established between pathfinder air traffic control facilities and colocated fire support elements to insure that timely and accurate information

concerning friendly fires is available to aircraft.

23. Terminal Guidance by Supported Units

a. There will be many requirements to assist in areas where TOE pathfinders are not available. This type of terminal guidance will normally be furnished by selected personnel within the supported unit using organic and improvised equipment.

b. Terminal guidance personnel should be familiar with supporting aviation unit *SOP* and be trained to—

(1) Operate electronic and visual navigation aids in order to assist aircraft in locating landing and/or drop zones.

(2) Provide limited essential information to and guidance and control of Army aircraft through ground-to-air radio.

(3) Reconnoiter for and recommend suitable landing and/or drop sites.

(4) Determine, recommend and/or accomplish necessary pioneer work to prepare landing and/or drop zones.

c. When TOE pathfinders accompany ground units, terminal guidance personnel may be used to augment pathfinder elements.

CHAPTER 3

CONTROL CENTER AND RELEASE POINT

24. Landing and/or Drop Zone Control Center

a. General. The purpose of the control center (CC) (fig. 2) is to control air traffic in and around a landing and/or drop zone and to promote safe, orderly, and expeditious air movement. The control center is the pathfinder command post and communications center for a particular landing site or drop zone.

b. Control Center Location. The pathfinder site commander selects the exact location of the control center upon arrival in the area. The CC is positioned to facilitate visual control of aircraft in and around the landing site or drop zone. For helicopter landing sites, the most desirable location of the CC is to the side of the centerline of the landing site and between the landing point of the lead aircraft and the departure end of the site. Such a position, particularly necessary at night, enables the pathfinder air traffic controller to best observe the final approach of formations of helicopters, insuring correct alinement with the required landing direction and sufficient obstacle clearance by means of visual steering instructions. At an airplane landing site, the CC is located where the best observation of all air and ground traffic can be obtained. The CC radios must be set up far enough from the landing, taxiing, and parking installations to prevent aircraft engine noise interference with radio transmissions. At a drop zone, the CC should be located at or near the code letter or the desired point over which the aircraft will initiate the drop, if different from the code letter location. The pathfinder commander normally locates himself at the most important site within the landing and/or drop zone. He monitors and/or directs pathfinder operations at outlying facilities by means of the path-

finder internal net, if the tactical situation and communication range permit.

c. Organization of the Control Center. A CC should be organized to meet the requirements of the mission. Of necessity, however, it may consist of only a single pathfinder operating the ground-to-air radio for a limited period of time at a small site. A type organization might be as follows:

(1) *Landing site and/or drop zone commander.* He supervises aircraft landings and departures, air drops, and other pathfinder activities at the site. For maximum utilization of available personnel, he may also be the ground-to-air radio operator ((2) below).

(2) *Ground-to-air radio operator.* He operates the radio used to maintain communication with aircraft, and provides the necessary voice air traffic control for his control zone.

(3) *Internal net radio operator.* He operates the radio used to maintain communication with other pathfinder elements when such a net is applicable and required. He aids in the control of aircraft by observation, and maintains a record (app B) of aircraft arrivals and departures and the general types of loads, if required.

(4) *Other personnel.* They are used to assist in carrying and installing equipment, clearing and/or marking of obstacles, and provide and other assistance necessary.

25. Release Point

a. General. A release point (RP) (fig. 3) is an established traffic control point and final navigational checkpoint for aircraft approaching the landing or air-delivery facilities within a landing and/or drop zone. The RP is also used by helicopter serials as a final coordination point for control of preplanned ground or

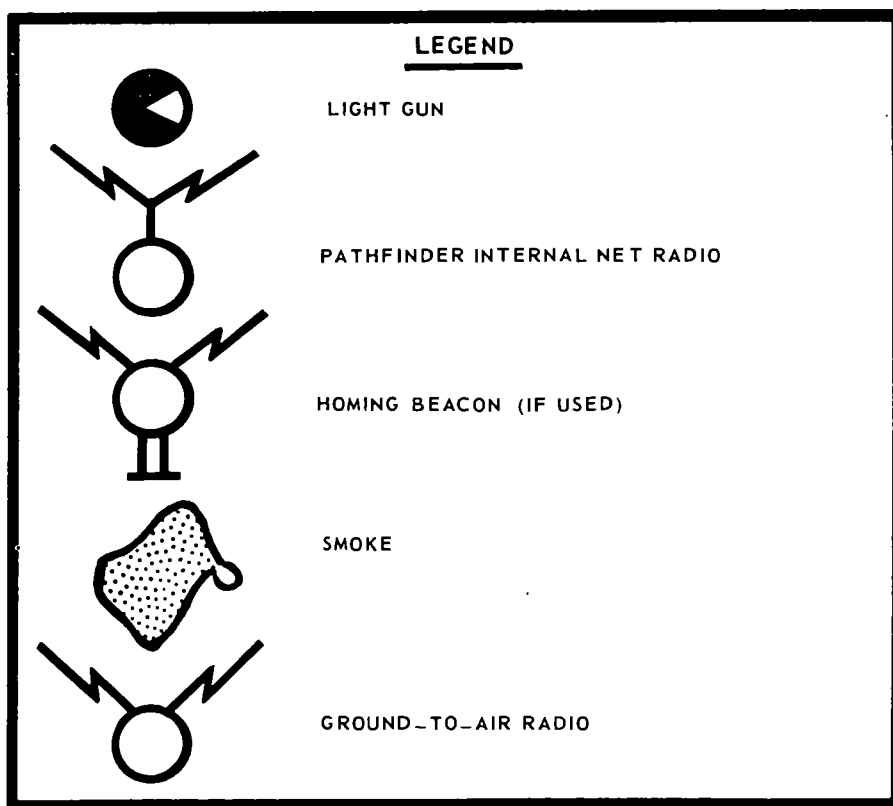
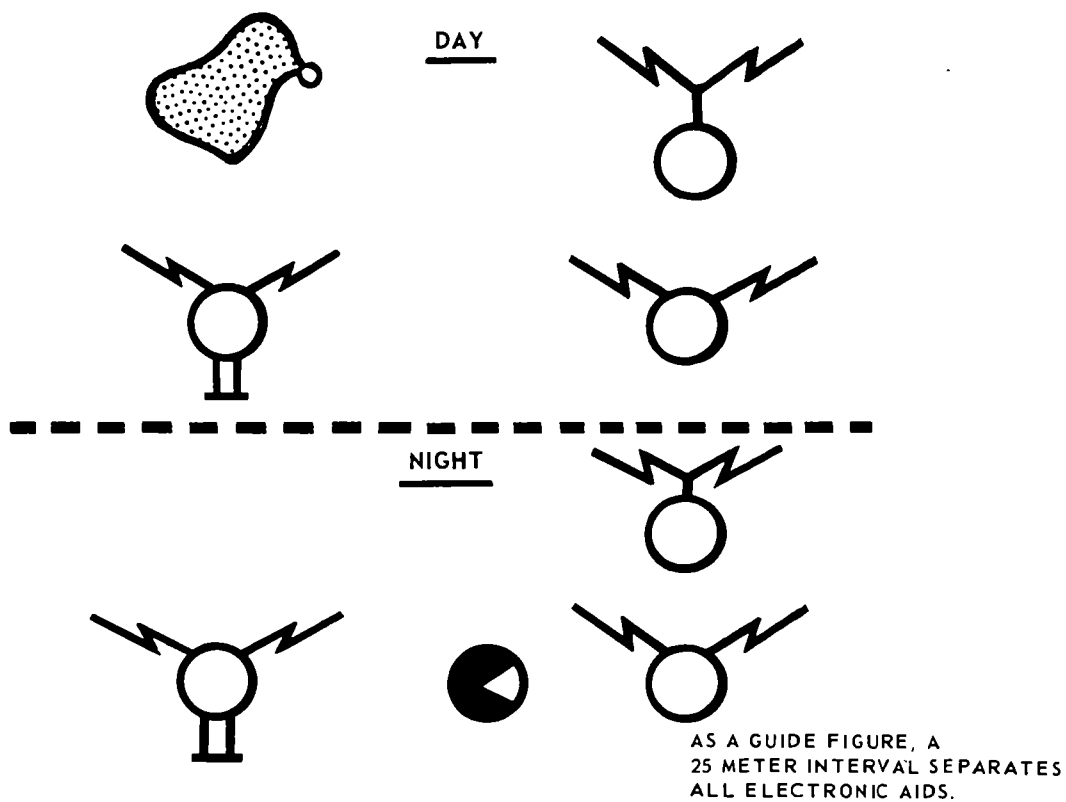


Figure 2. Control center (CC).

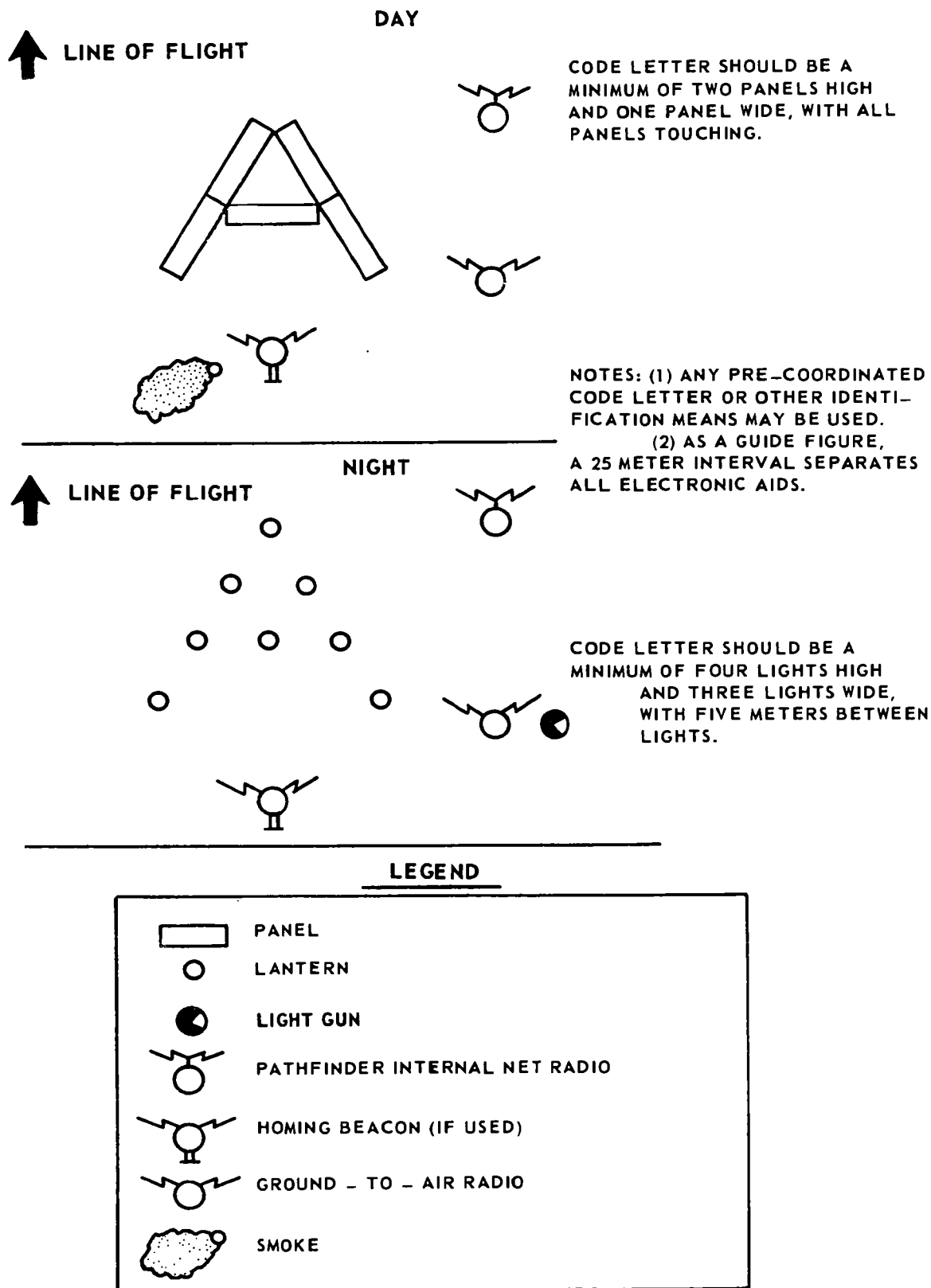


Figure 3. Release point (RP).

aerial supporting fires in and around landing sites during the air movement phase of an air-mobile assault. The RP is normally *not* manned, unless the location coincides with a relatively secure area or if extremely difficult navigational problems are anticipated by the aircraft. The location is tentatively selected from map and airphoto studies as an easily identifiable point on the planned flight route to the landing zone. If manned, the RP should be located on or near a prominent terrain feature or on high, open terrain which allows maximum effective use of long-range electronic and visual navigational aids.

b. Organization and Duties of the RP Party.

(1) When the RP is manned, the RP party normally consists of two or three pathfinders or, as a minimum it may consist of one pathfinder with attachments. The pathfinders position and operate the electronic and visual navigation aids. They also operate radios in the pathfinder internal net (if used) and the ground-to-air net. Monitoring the ground-to-air net permits personnel at the RP to respond immediately to requests from aircraft for assistance in locating the RP.

(2) The party may include attached personnel from supported units who are used to provide security for the RP and assist in carrying and operating equipment.

c. Operation of the RP.

(1) The pathfinder in charge of the RP, assisted by available personnel as needed, immediately installs the navigation aids upon

arrival at the RP site or according to plan. Whenever possible, aids should be established concurrently. If a priority for installing these aids is required due to limited personnel or other factors, then the priority below should be used.

(a) The ground-to-air radio is placed into operation first. The electronic homing beacon is then installed, if requested by the aviation unit commander, since it affords long-range guidance and greater security than visual aids. If used, the beacon will be located far enough away to prevent excessive interference with the radios and to reduce the possibility of enemy fire destroying radios and beacon simultaneously.

(b) The visual navigational aids are then prepared for operation. Visual navigation aids employed will vary in number and type depending upon aviation unit SOPs and requirements, and the necessity for security (fig. 3). Grass or brush may have to be removed to prevent masking these aids.

(2) The pathfinder internal net radio operator establishes communication with the landing site (CC(s)) as quickly as possible to report the state of readiness of the RP and provide information on the enemy situation at his location. He constantly monitors his radio, unless directed to operate on a definite time schedule.

(3) Security personnel move to assigned locations and take up security positions or assist in establishing and operating navigation aids and communication equipment.

CHAPTER 4

HELICOPTER LANDING ZONES

26. General

A helicopter landing zone contains one or more helicopter sites. A control center is established at each landing site, and a release point (manned or unmanned) normally is selected for the landing zone.

27. Selection of Landing Sites

a. The ground unit commander, in coordination with the supporting aviation unit, will select the location of helicopter landing zones to best support the ground tactical plan.

b. Minimum landing space requirements and minimum distances between aircraft on the ground depend upon a number of variables. These requirements normally will be covered by aviation unit SOPs or prearranged by the aviation unit commander in coordination with the pathfinder commander. The final decision concerning minimum landing requirements rests with the aviation unit commander. In selecting helicopter landing sites from maps, aerial photographs, and actual ground or aerial reconnaissance, the following factors are considered:

(1) *Size of landing point.* As a guide, a helicopter requires a relatively level, cleared, circular area at least 20–75 meters in diameter for landing, depending upon the type of helicopter. The area around the landing point must be cleared of all trees, brush, stumps, or other obstacles that could cause main or tail rotor blade strikes, damage to the underside of the helicopter, or other hazards. Generally speaking, a helicopter will require more usable landing area at night than during the day.

(2) *Number of helicopters used.* An important factor is the number of helicopters required to land simultaneously at one location to accomplish the mission. It may be necessary to provide an additional landing site nearby or

to land aircraft in successive flights at the same site.

(3) *Landing formation.* Planned landing formations may require modification in order to allow helicopters to land in restricted areas. Whenever possible, it is desirable to land aircraft in the same formation in which they are flying (fig. 4). If a modification in flight formation is required for landing due to restrictions of the landing site, the change requiring the least shift of aircraft should be used.

(4) *Surface conditions.* Surface conditions must be firm enough to prevent helicopters from bogging down, creating excessive dust, or blowing snow. Rotor wash on dusty, sandy, or snow covered surfaces may cause loss of visual contact with the ground and should be avoided, especially at night. Loose debris that may cause damage to the rotor blades or turbine engines must be removed from landing points.

(5) *Ground slope.* Normally, if the ground slope is greater than 15 percent, helicopters cannot land safely. When the ground slope is less than 7 percent, helicopters should land up-slope. In areas where the ground slope is from 7 to 15 percent, aircraft must land and park side slope. It is sometimes possible, however, for helicopters to terminate at a hover over ground slopes greater than 15 percent in order to load or unload personnel or supplies.

(6) *Approach and/or departure directions.* The directions of landing should be over the *lowest* obstacles and *generally* into the wind, especially at night. However, if there is only one satisfactory approach direction due to obstacles or the tactical situation, or if it is desired to make maximum use of available landing area, most aircraft can land with a crosswind (10 knots or less) or a tailwind (5 knots or less). The same considerations apply to departure from a landing site.

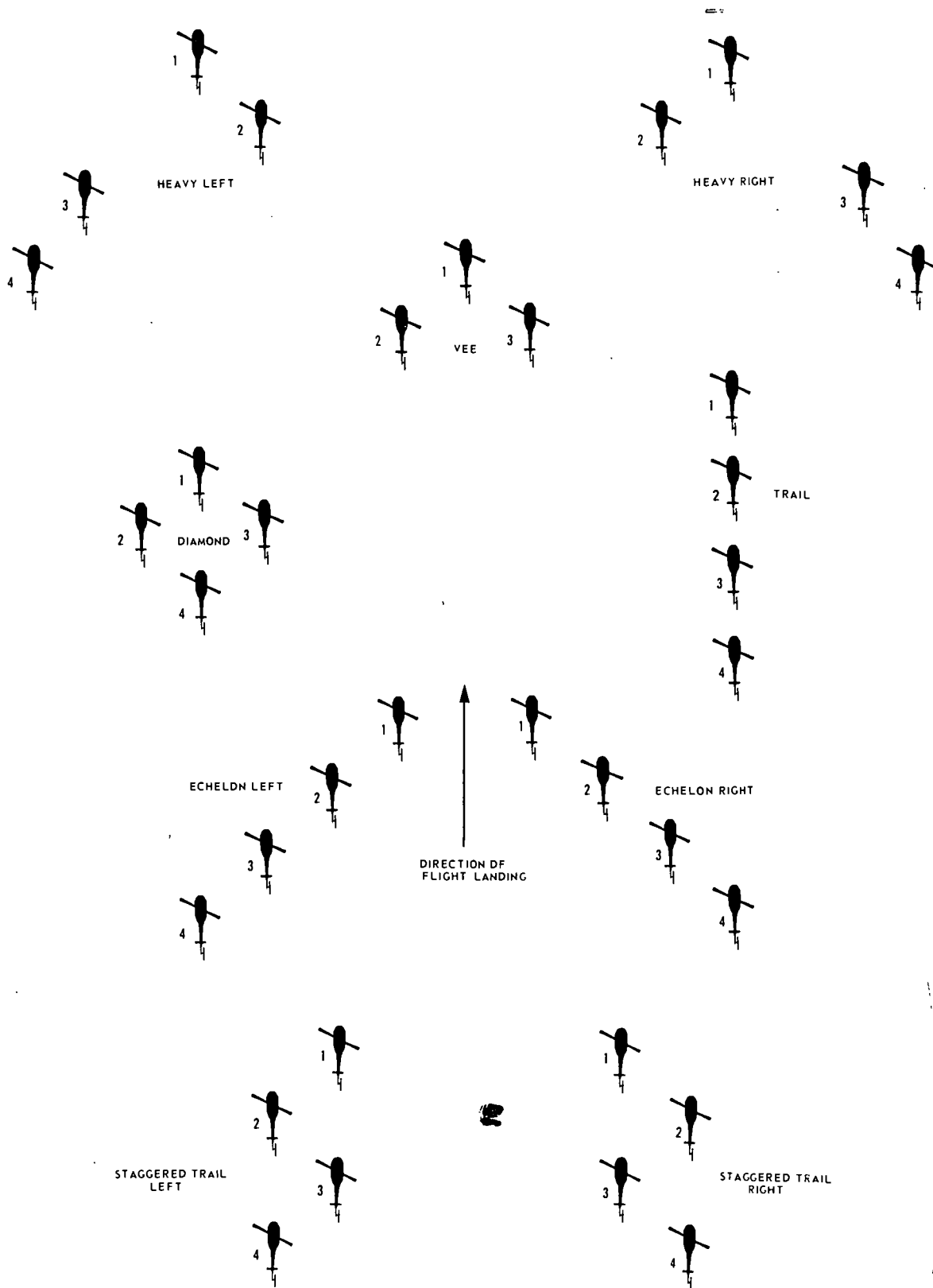


Figure 4. Standard flight and landing formations.

(7) *Prevailing winds.* Of the two factors—approach and/or departure routes (6) above, and prevailing wind—the best approach and/or departure route is the more important factor, unless the crosswind velocity exceeds 10 knots. The ability to land crosswind or downwind will vary, depending upon the type aircraft. Smaller aircraft can accept less cross or tailwind than larger, more powerful aircraft.

(8) *Density altitude.* The density altitude is determined by altitude, temperature, and humidity. For planning purposes, as density altitude increases, the size of the landing site must be increased proportionately. Generally speaking, high, hot, and dry conditions at a given landing site will decrease the lift capabilities of helicopters using that site.

(9) *Loads.* Most helicopters cannot ascend or descend vertically when fully loaded; therefore, a larger area and better approach and/or departure routes are required for fully loaded helicopters than for empty or lightly loaded ones.

(10) *Obstacles.* Landing sites should be free of tall trees, telephone or power lines, or similar obstructions on the approach or departure ends of the landing site that may interfere with helicopter landings or takeoffs. Obstacles within the landing site, such as rocks, stumps, and holes that cannot be eliminated must be clearly marked (see para 29b(3)). For planning purposes, an obstacle ratio of 10 to 1 should be used; that is, a landing point requires 100 feet of horizontal clearance from a 10-foot tree if aircraft must approach or depart directly over the tree.

c. Detailed information of the effects of air density, slope, and surface conditions on landing site requirements is contained in appropriate technical manuals. The helicopter unit commander makes the final decision on minimum landing requirements. These requirements must be available to the pathfinder and ground unit in the form of *SOPs* or verbal instructions in the early planning stages of the mission.

d. Alternate sites may be needed because of enemy action, unfavorable terrain conditions, or changes in the tactical or logistical situation. They are selected by the ground unit commander primarily to support the tactical plan. On the recommendations of the aviation unit commander and the pathfinder on the site,

the ground commander or his representative decides when alternate sites will be used. Instructions concerning the use of alternate sites must be disseminated to pathfinders by the most expedient means available. Pathfinder and aviation unit commanders do not have the authority to shift to alternate landing sites, unless such authority has been specifically delegated by the supported ground unit commander.

28. Unit Organization and Duties

The pathfinder unit is organized for combat to establish and operate the number of installations required by the tactical plan of the supported unit(s). These facilities may all be within a single landing zone or widely separated throughout a large area of operations. The pathfinder commander normally positions himself at the most important site.

a. *Control Center and Release Point.* A control center (CC) must be established at each landing site to adequately control air traffic. A manned or unmanned release point (RP) is normally established on the flight routes into the landing zone as determined by aviation requirements. The CC routes into the landing zone are determined by aviation requirements. The CC and RP (when manned) are organized and operated as described in Chapter 3.

b. *Landing Site Party.* This party consists of a site commander and additional pathfinder and/or attached personnel, as required. Out of necessity, a single pathfinder could establish and operate a small landing site for limited periods of time.

(1) The site commander is responsible for the reconnaissance, establishment, and operation of the helicopter landing site. He supervises the site and at any time, if required, may perform the duties of any member of the site party. His most common additional duty is acting as the ground-to-air radio operator.

(2) The number of additional pathfinder personnel employed is dictated by the size of the landing site, the density of expected air traffic, the number and type visual and electronic aids to be used, and the tactical situation. Additional personnel operate the ground-to-air radio, the pathfinder internal net radio (if established), position and operate navigational and assembly aids, and clear and/or mark all obstacles within their capabilities.

(3) Other personnel from supported units may be attached to the landing site party to provide security, assist pathfinders in establishing and operating the landing site, reconnoiter and mark assembly areas, and operate assembly aids. Use of attached personnel, if any, to assist pathfinders should be carefully planned ahead of time. These personnel must be thoroughly briefed and rehearsed. If they are given a reconnaissance assignment, it should not include actual landing areas; these areas should only be reconnoitered by pathfinders.

29. Establishment of the Landing Site

a. Communications are established in the ground-to-air net and the pathfinder internal net (if used) immediately upon arrival at the landing site. These radio nets are monitored at all times, unless otherwise directed, until operations at the site are completed. It is desirable that each helicopter landing site be within ground communication range of the other sites and the release point, if manned. However, the tactical situation may often preclude this. The range of available radios will dictate the ability to communicate with other facilities within the landing zone.

b. The helicopter landing site commander rapidly reconnoiters the area to determine the exact direction of landing, and calculates an intercept heading from the RP, if necessary (see (6) below). He selects the location of the landing point of the lead aircraft of each flight, and determines if the terrain or situation dictate any change to the preplanned landing formation. The site commander must also insure that necessary landing instructions are compiled for transmittal to inbound aircraft, and that obstacles to aircraft in or around the site are expeditiously removed or marked.

(1) Preferably, helicopters should land simultaneously in the preplanned flight formations (fig. 4). If it becomes necessary to land the helicopters in a formation different from that in which they are flying, the landing site commander must insure that this information is given to the flight leader as part of the landing instructions (para 30). The exact layout of the landing site depends upon the helicopters not flying directly over other aircraft on the ground, available landing space, number and

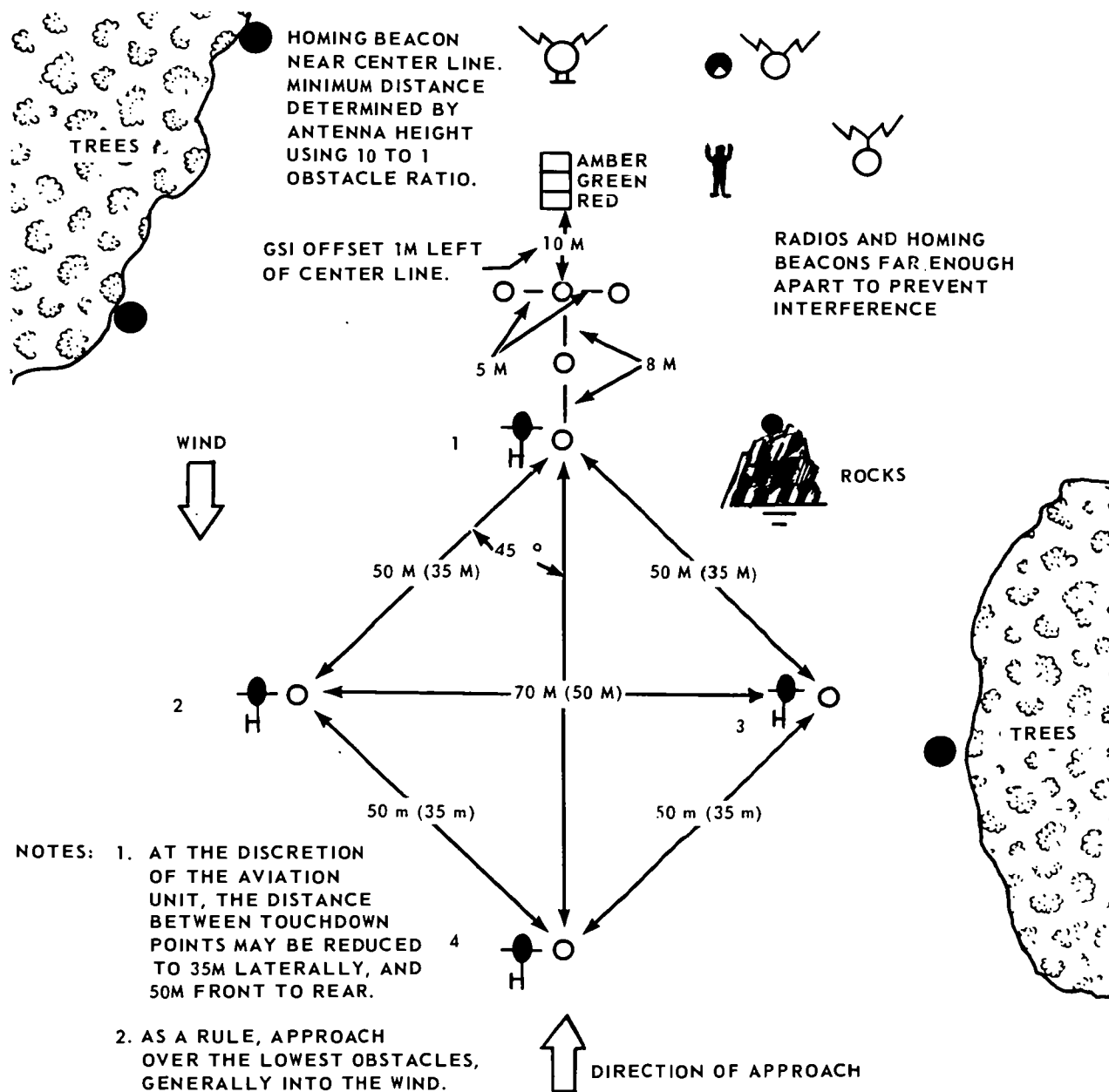
type of obstacles, unit SOPs, and prearranged flight formations. When helicopters are to land in trail formation, the landing points should be staggered laterally, unless terrain dictates otherwise (such as, landing on a road), in order to reduce the danger of collision, especially at night.

(2) Normally, no landing zone marking is used during day operations, except smoke or other minimum identification means. Lanterns or field expedients are used to indicate the direction of landing and to mark individual landing points for a night operation (figs. 5, 6, 7, 8, and 9). Lights of different colors may be used to designate different helicopter sites or to separate flights within a larger formation. A lighted tee indicates the landing point of the lead aircraft of each flight and the direction of approach. Additional lights are provided for touchdown points of other aircraft in the flight. Helicopters should land with the right landing gear or skid just to the left of the light. All lights should be hooded or turned upside down for security purposes until the last practicable movement when aircraft are inbound. Lights should be beamed in the direction from which the helicopters approach. It is desirable that a signaller be used to land the lead aircraft, especially at night.

(3) Obstacles must be marked for daylight and night airmobile operations.

(a) During daylight airmobile operations, obstacles that may be difficult to detect and impossible to remove, such as wires, holes, stumps, and rocks should be marked with red panels or any other easily identifiable means.

(b) During night airmobile operations, red lights will normally be used to mark all obstacles within a landing site that cannot be easily eliminated. In most combat situations, it is impractical for security reasons to use red lights to mark the tops of these on the approach and departure ends of a landing zone. In a training situation, however, or in a rear area landing site, red lights should be used whenever possible. In the event that obstacles and/or hazards cannot be marked, aviators should be thoroughly advised of existing conditions by ground-to-air radio. In any case, the pathfinder landing site commander must insure that the most dangerous obstacles are marked first and eliminated, if possible at the earliest practicable time.



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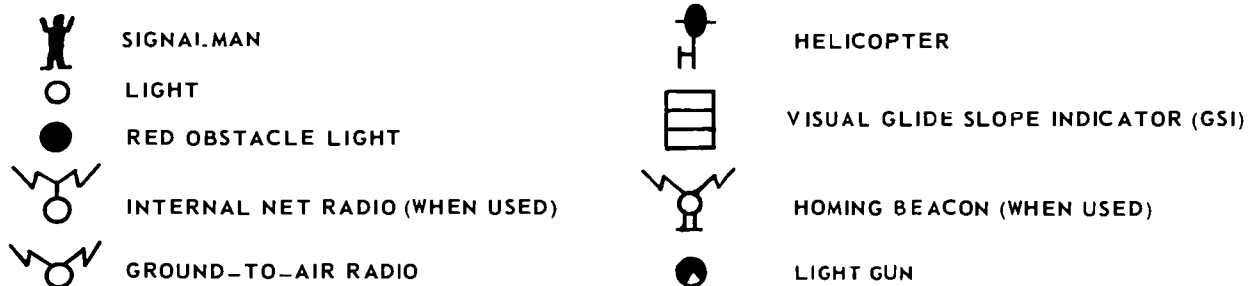


Figure 5. Night UH-1 landing site—diamond formation.

SYMBOLS AND LOCATION OF HOMING BEACON,
SIGNALMAN, GLIDE SLOPE INDICATOR AND RADIOS
SAME AS SHOWN IN FIG 5. NOTES FOR FIG 5. APPLY.

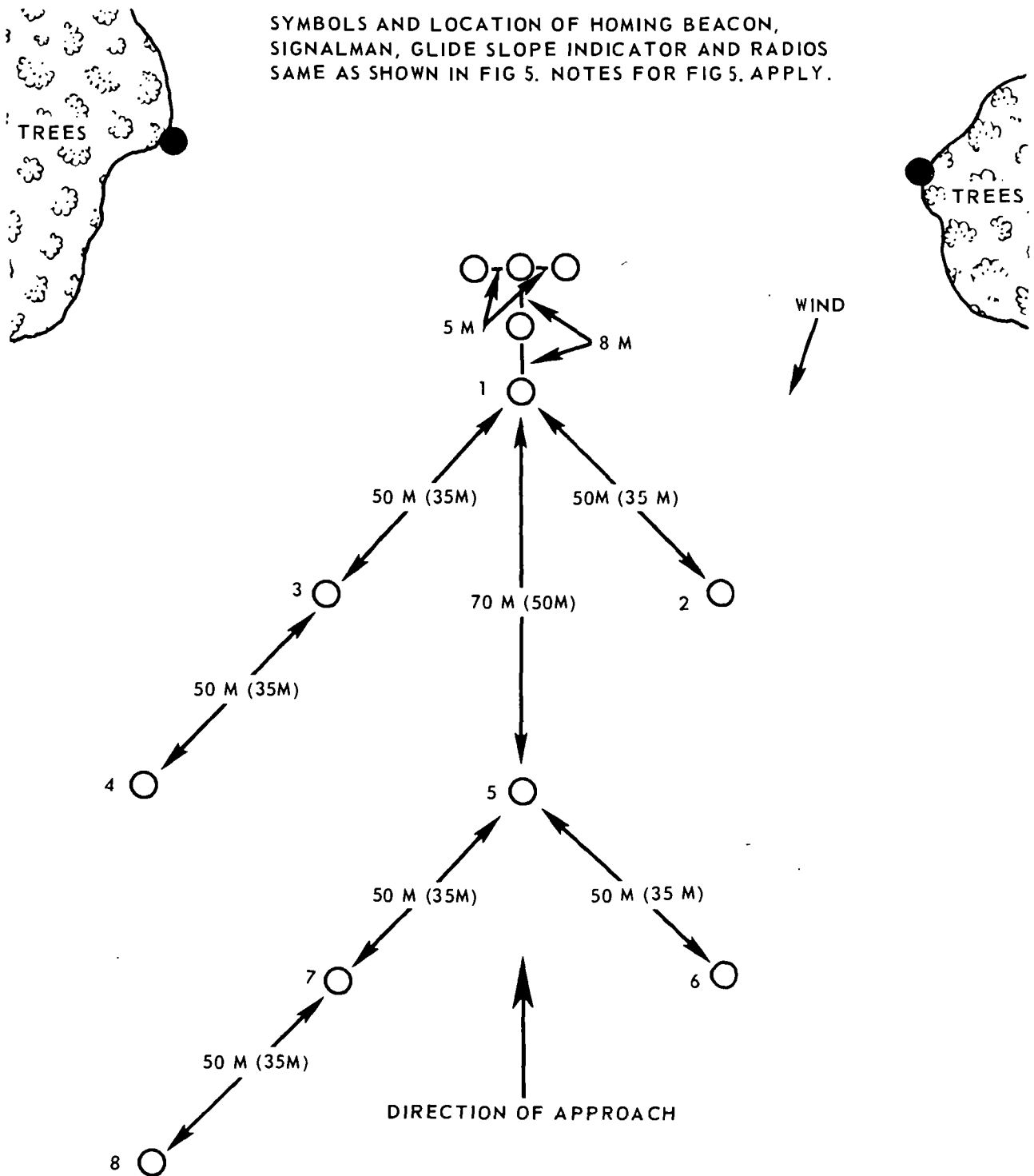


Figure 6. Night UH-1 landing site—flights heavy left formation.

(4) Pathfinders may mark initial assembly points for troops, equipment, and supplies if required by the supported unit. These points

are located to facilitate assembly and clearing of the helicopter site quickly and efficiently. If unit assembly areas are to be used, they are

NOTES, SYMBOLS AND LOCATION OF
HOMING BEACONS, RADIOS, GLIDE
SLOPE INDICATOR SAME AS FIG. 5.

NOTE: DISTANCES BETWEEN
PLATOONS MAY BE
REDUCED TO 70 AND
105 M RESPECTIVELY
AT DISCRETION OF
AVIATION UNIT.

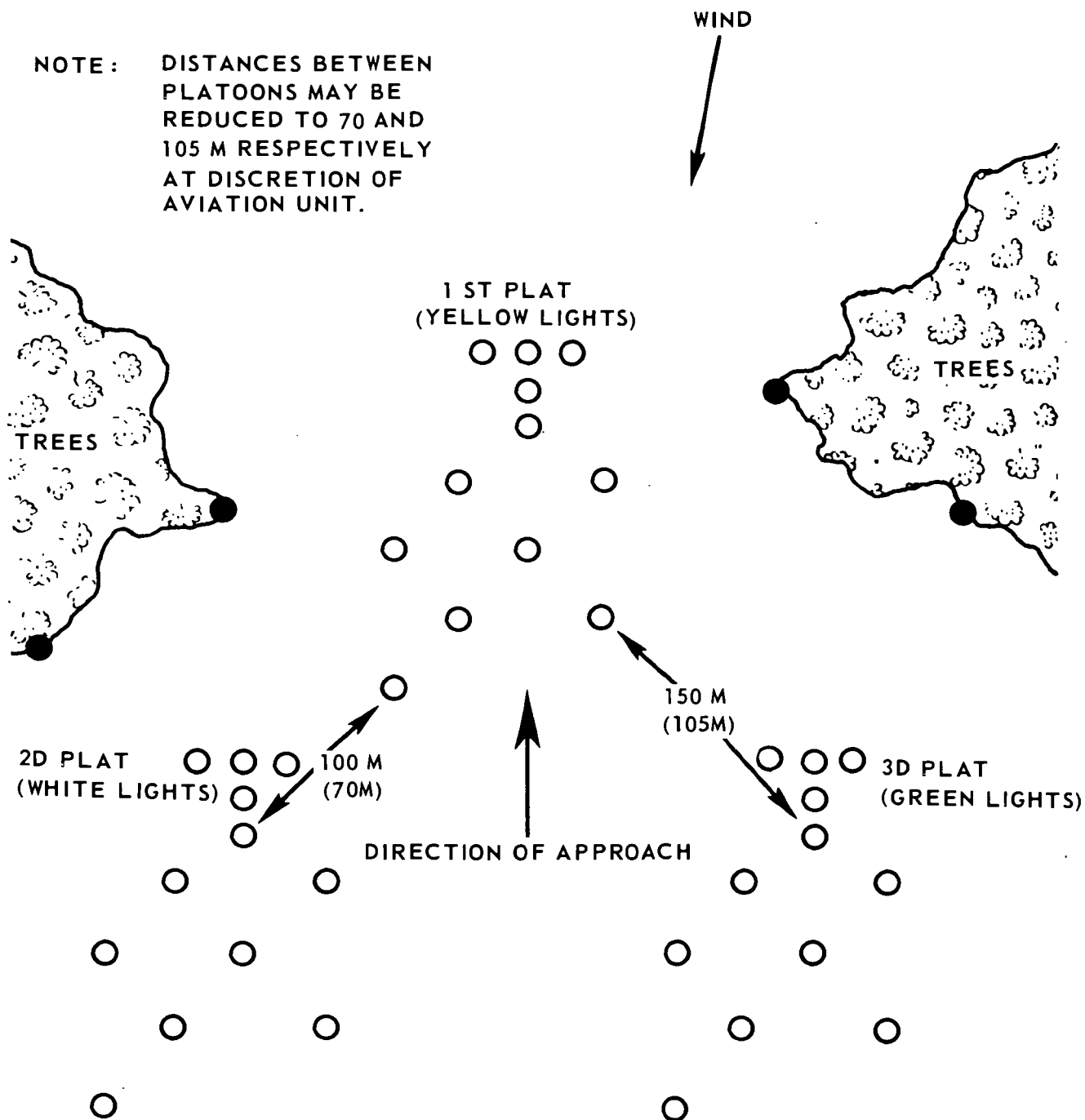


Figure 7. Night UH-1 landing site—company vee, flights heavy left.

pre-selected by the ground unit commander. If the requirement exists, supported ground unit personnel will accompany the pathfinders

to reconnoiter and mark the unit assembly areas, establish assembly aids, act as guides, and assist in loading and/or unloading opera-

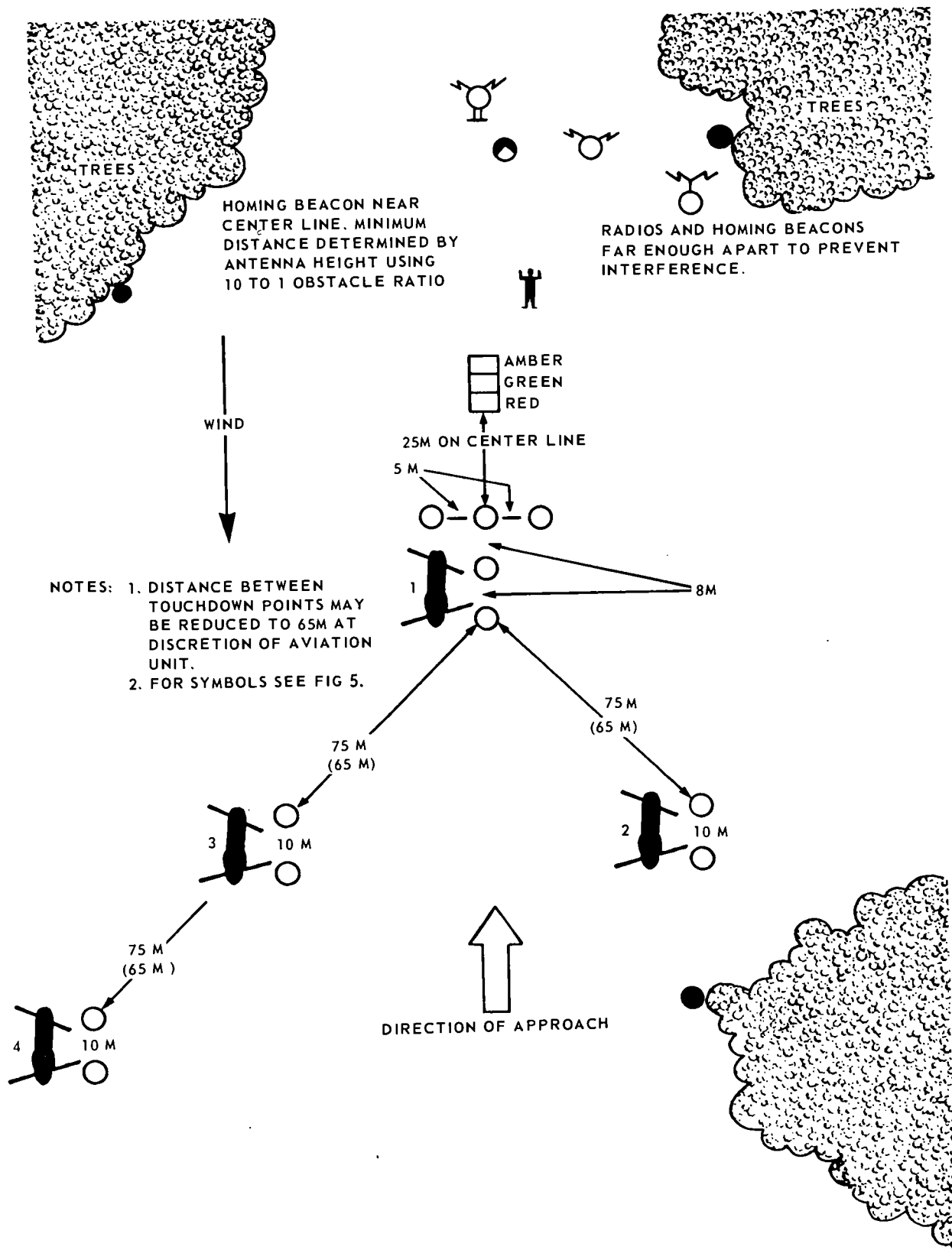
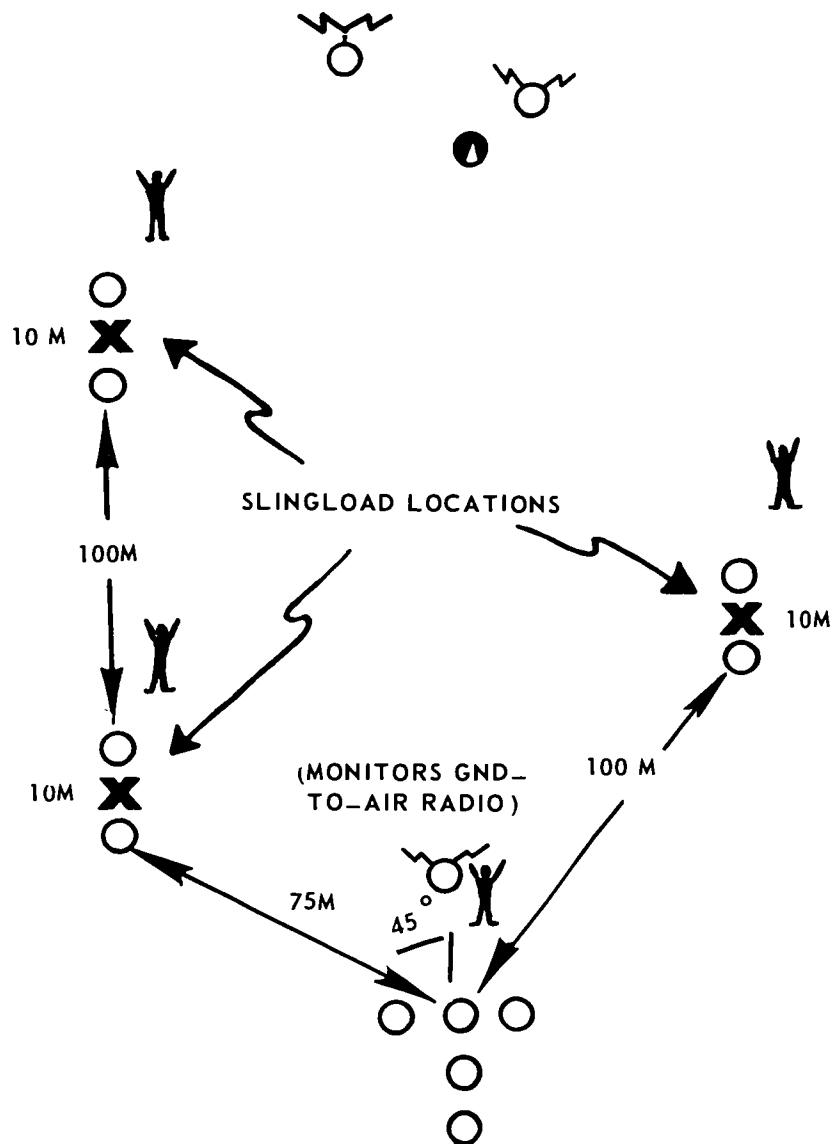


Figure 8. Night CH-47 landing site—heavy left formation.



- NOTES:
1. FOR SYMBOLS SEE FIG.5.
 2. THE NUMBER OF LOAD POINTS ESTABLISHED IS DETERMINED BY AVAILABLE AREA AND MISSION REQUIREMENTS.
 3. EACH AIRCRAFT MAKES APPROACH TO TEE AND HOVERS TO DESIGNATED LOAD POINT AT DIRECTION OF CC.
 4. HOOKUP MEN AT LOAD POINTS SHOULD BE PROVIDED BY LIFTED UNIT.
 5. PFDR INTERVAL NET MAY BE USED AS REQUIRED THROUGHOUT THE SITE.

Figure 9. Night CH-47 slingload pickup and/or drop site.

tions in order to insure the rapid clearing of personnel, supplies, and equipment from the immediate vicinity of the landing points.

(5) Pathfinders have a limited security capability. If pathfinders preceded the initial assault elements into a landing site, personnel from the supported ground unit may accompany them for security purposes.

(6) If possible, the heading from the RP (or CCP if no RP is used) to the landing site should coincide as closely as possible with the actual landing direction to preclude sharp turns with formations of aircraft. The larger

the formation, the more important this becomes. If a straight-in approach for landing is not possible, then an "intercept heading" should be established (fig. 10). The intercept point should be far enough away from touchdown that it will allow aircraft in formation a final approach of at least 1 to 2 miles. Visual steering commands, time and/or distance, terrain features, and electronic or visual navigational aids may be used by flight leaders to determine the intercept point with the required landing direction at the landing site.

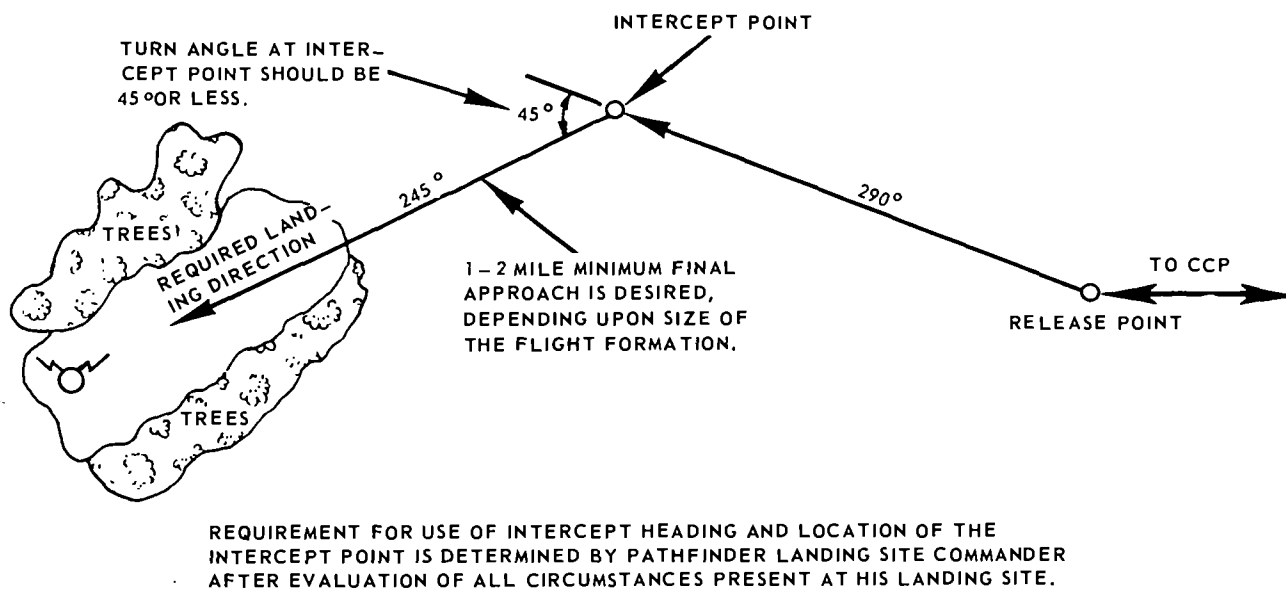


Figure 10: Intercept heading technique.

30. Operation of the Helicopter Landing Zone

a. Helicopters normally approach the landing zone along a designated flight route. They are normally organized into serials containing one or more platoon-size flights. One serial may contain a flight for each helicopter site. However, flights of medium or heavy transport helicopters (CH-47 and CH-54) carrying artillery or other bulk cargo can often be expected to arrive at landing sites in increments of one or two aircraft at a time. Subsequent flights follow a minimum time intervals. The minimum allowable time between flights will depend on such factors as the number of aircraft per flight, the configuration and condi-

tions of the landing site, and the nature of the cargo to be loaded or off-loaded. Time between successive flights will be determined by the aviation unit commander during the planning phase of an operation. Once an operation is in progress, pathfinders at the site may recommend changes to insure aviation safety or expedite operations.

b. As each helicopter serial reaches the communication checkpoint (CCP) on the flight route, the flight leader initiates communication with the appropriate helicopter landing site control center (CC). The CC then furnishes the flight leader with information concerning the heading from the CCP to the RP, the heading from the RP to the landing site, land-

ing direction, other pertinent information, such as the enemy situation, friendly fires, field elevation, landing formation, terrain conditions, traffic situation, obstacles, availability of smoke or light gun, glide slope indicator setting, and the next reporting point. Normal-

ly, all aircraft in a flight switch to the pathfinder control frequency on instructions of the flight leader prior to reaching the CCP. Radio messages between a landing site CC and a flight leader might be as follows:

<i>Speaker</i>	<i>Topic</i>	<i>Message</i>
Flight leader -----	Identification, location -----	HOTEL CONTROL, THIS IS HAWK ONE AT CCP, OVER.
Pathfinder at landing site ----	Acknowledgement ----- Heading from CCP to RP. Landing site heading (from RP to landing site). Landing direction ----- Other pertinent information.	*HAWK ONE, THIS IS HOTEL CONTROL; HEADING TWO EIGHT ZERO; LANDING SITE HEADING TWO NINER ZERO (OR, IF INTERCEPT HEADING IS REQUIRED: HEADING FROM RP THREE ONE ZERO TO INTERCEPT TWO NINER FIVE); *LAND TWO NINER FIVE; *ENEMY SITUATION NEGATIVE, SMOKE ON CALL, STUMPS ON LANDING SITE;
	Clearance to approach and next reporting point.	*REPORT ONE MILE FINAL.
Flight leader -----	Acknowledgement -----	*HAWK ONE, ROGER OUT.
Flight leader -----	Identification, location -----	*HOTEL CONTROL, HAWK ONE; ONE MILE FINAL.
Pathfinder at landing site ----	Acknowledgement and final clearance to land.	*HAWK ONE, HOTEL CONTROL; WIND THREE ONE ZERO DEGREES AT FIVE, CLEAR TO LAND.
Flight leader -----	Acknowledgement -----	*HAWK ONE, ROGER.
Flight leader -----	Request for permission to take-off.	*HOTEL CONTROL, HAWK ONE; REQUEST TAKE-OFF.
Pathfinder at landing site ----	Acknowledgement and instruction for take-off.	*HAWK ONE, HOTEL CONTROL; WIND THREE ONE ZERO DEGREES AT FIVE, CLEAR FOR TAKE-OFF.

*Pathfinders must be prepared at all times to provide air traffic control and navigational assistance to any aircraft in and around landing site in the event these aircraft do not follow a specified flight route. Radio transmissions from a landing site CC to an aircraft approaching the site from a direction other than along a flight route with a specified CCP and RP would be as shown above by the asterisk.

c. The helicopter formation continues along the flight route to the RP. Pilots are assisted by the electronic and visual navigational aids at the RP, if manned. All helicopters pass over or near the RP, with serial leaders normally reporting passage of the RP to their respective landing site CC, and move directly to their assigned landing site. The individual landing site CC furnishes assistance to any flight which cannot locate its site. This assistance is accomplished using visual signals, steering commands, or electronic homing techniques.

(1) For daylight operation, a specified smoke color may be assigned to separate landing sites to aid identification. Since the number of smoke colors is limited, the same color may have to be used by more than one helicopter site. Sites that use the same color should be located farthest apart. When smoke is used, care must be taken to avoid starting grass fires or masking the landing points. Smoke should be employed sparingly, because it distinctly marks a location not only for friendly forces, but for enemy observers as well. Generally, smoke is used only in response to an aviator's request for help in identifying or locating his helicopter site.

(2) For a night operation, pyrotechnics or other visual signals are used in place of smoke. As in daylight, red signals should be used only to mean DO NOT LAND or to indi-

cate other emergency conditions. Emergency codes must be preplanned and thoroughly understood by all concerned.

d. Each flight lands at its assigned helicopter site in the manner indicated by CC messages and visual aids displayed. Pathfinders may use arm-and-hand signals (app F) to assist in controlling the landing, hovering, or parking of helicopters.

31. Sling Loading Procedures

a. Helicopters are often employed to move cargo as external (sling) loads. This may be required in any of the following situations:

(1) When the cargo compartment of the helicopter is too small for the load.

(2) When the center of gravity limitation of the aircraft is exceeded by the characteristics of the load.

(3) When the maximum speed of loading and/or unloading is a requirement.

(4) When the conditions on the landing site prevent touchdown of the aircraft.

b. Pathfinders must be prepared to organize and control external load pickup or drop-off sites as an integral part of normal operations. Sling loads of artillery or other bulk cargo

are routinely planned as a followup to airmobile assaults. The air traffic control procedures for sling load operations are basically the same as for airlanded operations. However, the pathfinder must be aware of the following considerations:

(1) A detailed load plan to include approximate weights and sequence of movement of loads should be provided by the supported unit to insure the correct and expeditious movement or placement of cargo.

(2) A larger area is often required for sling loading operations. Condition of the area, such as dusty surface and obstacles will often dictate the spacing of loads, the number of helicopters that can safely operate in the site simultaneously, and the overall speed of the operation.

(3) Rigging of the loads will normally be the responsibility of the lifted unit. However, pathfinders should check weight, rigging, and positioning of all external loads to insure aircraft safety.

(4) Ideally, signalmen and hookup men for individual loads should be provided by the lifted unit.

CHAPTER 5

AIRPLANE LANDING ZONES

32. General

a. This chapter contains procedures and guide figures for planning purposes which, under extreme or difficult situations, may require alteration. Coordination with the aviation units involved will determine specific requirements for the establishment and operation of airplane landing zones.

b. Airplane landing zones are established so that Army airplanes may safely and expeditiously land and takeoff. The landing zone also provides guidance for airplane taxiing and parking while they are on the ground. An airplane landing zone has one or more landing strips. The landing strip consists of a runway, and may include taxiways, parking points, and dispersal areas. The pathfinder section is capable of establishing and operating two airplane landings simultaneously. The strip is marked visually (figs. 11 and 12), and it operates with much greater efficiency and safety when radio control is provided.

33. Classification

Landing strips are classified according to their degree of improvement. The three classifications are pioneer, hasty, and deliberate.

a. *Pioneer*. A pioneer landing strip usually has an unimproved surface, which normally is good only for fair weather operation. This type of strip has the following characteristics:

- (1) Minimum length: 1,200 feet.
- (2) Minimum width: 50 feet.
- (3) Minimum lateral clearance: 75 feet each side of runway centerline.
- (4) Taxiways and parking areas: not normally required.

b. *Hasty*. A hasty landing strip also has an unimproved surface, which is normally good for marginal weather, but is unusable during prolonged periods of poor weather. Most pio-

neer landing strips, terrain permitting and after a period of occupation, can be improved to meet the requirements of a hasty landing strip. A hasty landing strip has the following characteristics:

- (1) Minimum length: 1,200 feet, plus a 10% overrun at each end.
- (2) Minimum width: 50 feet, plus a 10 foot shoulder on each side.
- (3) Minimum lateral clearance: 100 feet each side of runway centerline.
- (4) Has taxiways, parking areas, and may include dispersal areas.

c. *Deliberate*. A deliberate landing strip has an all-weather capability. As a minimum, it will have all the characteristics of a hasty landing strip plus any other facilities which may be needed to meet the standards required by any using aircraft. A deliberate strip is usually a permanent installation with a control tower, hard surface runways, taxiways, and parking ramps.

Note. When it is anticipated that USAF troop carrier aircraft may use landing strips established by Army pathfinders thorough coordination must be effected with USAF and engineer elements to insure minimum safety requirements are met.

34. Selection of Airplane Landing Facilities

After a period of improvement, it is usually desirable that landing strips have taxiways, parking areas, and dispersal areas. Landing strips should be selected in areas where these installations can be established easily and yet meet prescribed minimum standards.

a. *Landing Strips*. A landing strip is a specified location within an objective area used for landing aircraft. It is selected to meet the requirements of the supported ground and using aviation unit.

- (1) *Surface*. The surface of a landing -

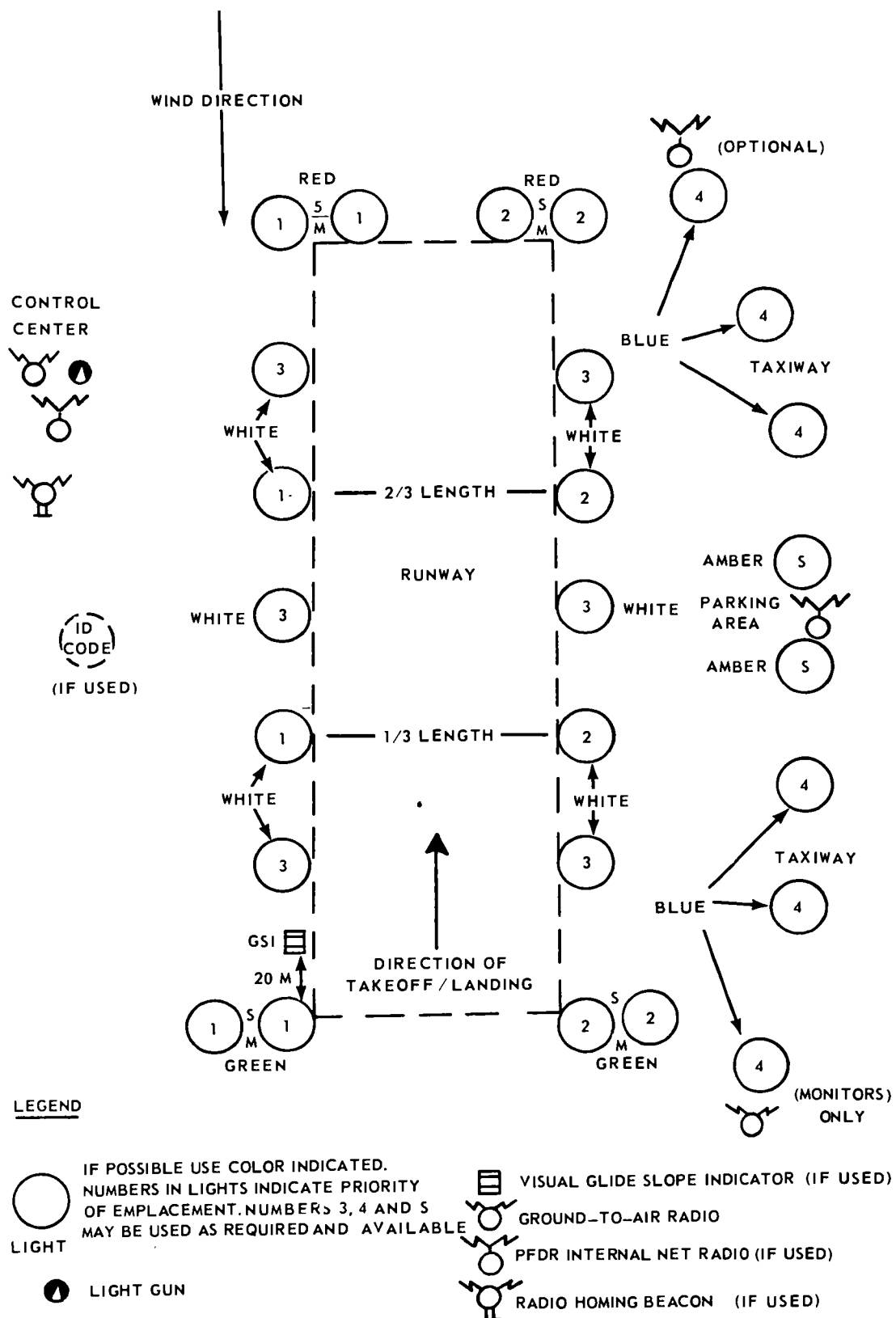


Figure 11. Airplane landing strip (night).

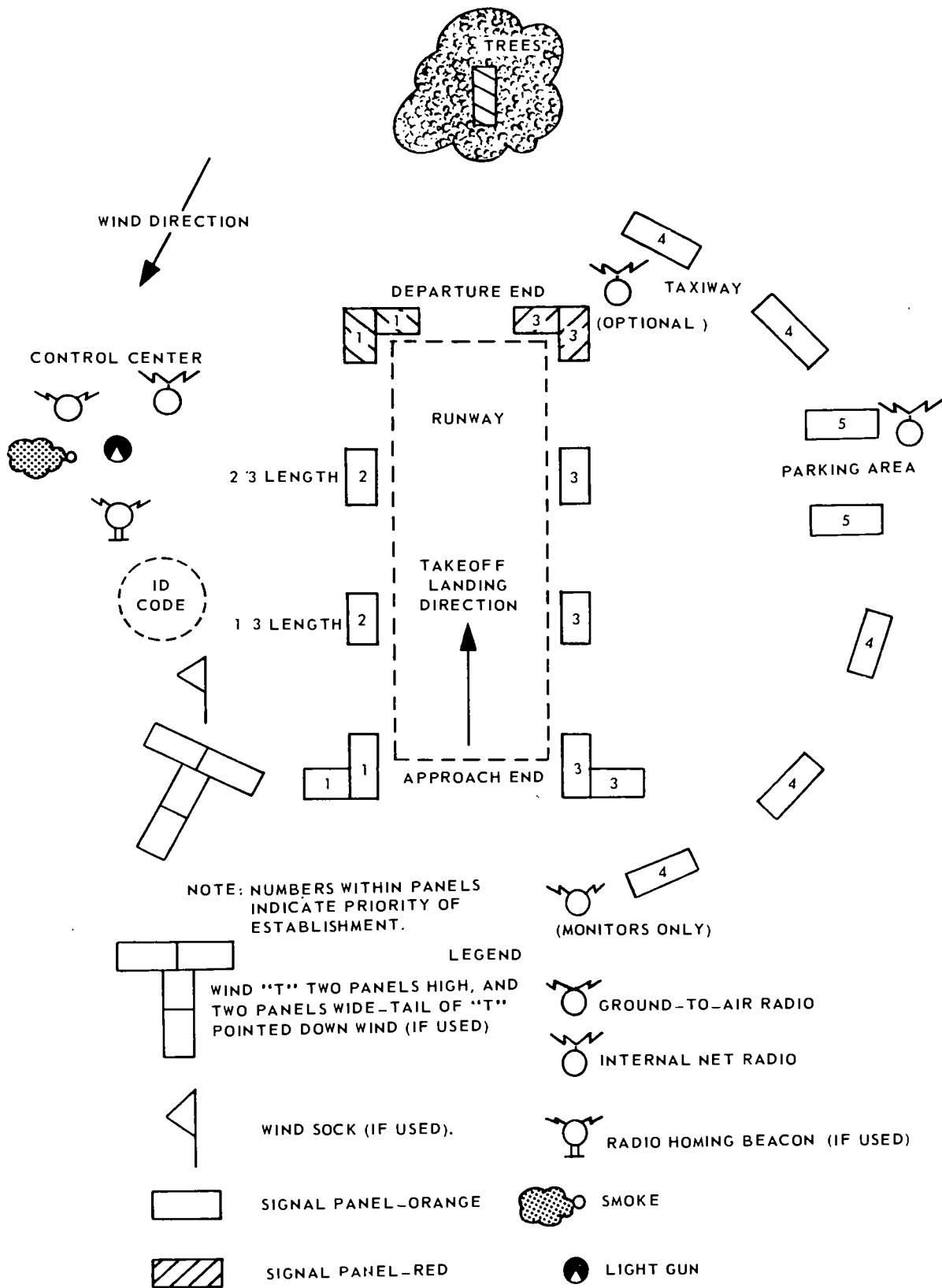


Figure 12. Airplane landing strip (day).

strip must be firm and smooth enough to allow heavily loaded aircraft to land, taxi, park, and takeoff without delay or damage to the aircraft.

(2) *Location.* The landing strip should be located in a level area, away from obstacles such as telephone wires and tall trees. If there are prevailing winds, the runway should be oriented, if possible, so that aircraft can land and takeoff into the wind.

(3) *Dimensions.* The minimum size of a landing strip will depend on the type of loads, the direction and velocity of the wind, the condition of the ground, and the location of obstacles. The aviation and pathfinder units jointly establish the minimum dimensions of a landing strip, with the final decision on size resting with the aviation unit. As a guide, the following factors should be considered in the establishment of a landing strip:

(a) Soft, wet, slippery, or any other unfavorable surface conditions will normally increase the required length of a runway by at least 7 percent.

(b) Crosswinds may also require an increase in the length of the runway by at least 7 percent.

(c) Uphill takeoffs and downhill landings may require longer runways. The maximum slope on any strip should not exceed 10 percent.

(d) If there are obstacles at the approach and departure ends of the strip, an obstacle clearance is measured from the obstacle to the approach and departure end panels and/or lights.

b. Taxiways. Taxiways should be prepared on one or both sides of the runway so airplanes can clear the runway as soon as possible after landing. Taxiways must be wide enough to permit the largest aircraft being used to taxi from the runway to the parking area. The following factors affect the location of taxiways:

(1) Taxiways parallel to the active runway should be separated from the runway by a minimum of two and one-half ($2\frac{1}{2}$) wing spans of the largest aircraft anticipated at the landing strip.

(2) The taxiways should be one and one-half ($1\frac{1}{2}$) times the width of the wheel base of the largest aircraft anticipated on the land-

ing strip, but not less than twenty (20) feet wide.

(3) Taxiways must be free of obstacles, smooth, and firm enough for aircraft to taxi without being damaged or bogging down.

c. Parking Areas. Parking areas are selected where aircraft can load and unload without interfering with the continuous operation of the landing area. More than one parking area may be needed to provide enough parking points for efficient operation of the landing strip. The following factors will affect the location of parking areas and parking points:

(1) Parking points should be separated from the active runway by a minimum of two and one-half ($2\frac{1}{2}$) wing spans of the largest aircraft anticipated to land.

(2) Parking points within the parking area should be separated by at least two (2) airplane lengths of the largest aircraft anticipated to arrive.

(3) Parking points should be located where aircraft can enter and leave the parking area without delay.

d. Dispersal Areas. Dispersal areas are used to park disabled aircraft and other aircraft scheduled to remain in the area. Ideally, dispersal areas should afford concealment from ground and air observation and, where possible, should have ground masks between aircraft. More than one dispersal area may be required to provide the necessary aircraft dispersion.

35. Organization and Duties

For maximum efficiency, pathfinders assigned to operate a landing strip are organized into three groups: a control center, a runway party, and a parking party.

a. Control Center (CC). The CC is the pathfinder command post and communication center at a landing strip. The CC should be organized to meet the requirements of the mission (fig. 2) and normally consists of the following personnel:

(1) *Landing strip commander.* Controls the operation of the landing strip and, in certain situations, also serves as the ground-to-air radio operator. He is responsible for—

(a) Designating and marking the exact limits of the landing strip.

(b) Clearing and maintaining the area within his capabilities.

(c) Insuring that safety procedures are observed.

(2) *Ground-to-air radio operator.* Operates the radio used to maintain air traffic control over aircraft on and around the landing strip.

(3) *Pathfinder internal net radio operator.* Operates the radio used to maintain communication with other elements of the section. Aids in the control of aircraft by observation and maintains a record (app B) of aircraft arrivals, departures, and the general types of loads carried.

(4) *Additional pathfinder personnel.* Within the control center, establish I. D. codes and/or homing beacons as required. They also may be used to provide security, assist in carrying and installing equipment, and carry out other tasks as necessary.

b. Runway Party. Reconnoiters, prepares, and marks the landing area. Runway party personnel perform the following tasks:

(1) *Assistant strip commander.* Supervises marking of exact limits of the runway and the preparation and improvement of the landing area.

(2) *Pathfinder internal net radio operator.* Maintains communication with the control center.

(3) *Other pathfinders.* Under the direction of the assistant strip commander—

(a) Mark the runway and remove and/or mark obstacles within their capabilities in the landing area and in the approach and/or departure zones.

(b) Install wind "T" or wind sock (if used).

(c) Provide local security.

(d) Install glide slope indicator (if used).

(e) Upon establishment of the landing area, perform additional duties as directed.

c. Parking Party. Reconnoiters, prepares, and marks the taxiways, parking areas, and dispersal areas. Provides parking and taxi signals for each airplane, and maintains ground communications with the CC. Parking party personnel perform the following tasks:

(1) *Parking party commander.* Directs the reconnaissance, preparation, and marking of the taxiway and individual parking and dispersal points for each airplane. He controls

the parking and taxi of airplanes; assists in the initial assembly of troops, equipment and supplies (as required), and furnishes information to the CC concerning the type of loads delivered to or taken out of the landing strip by aircraft.

(2) *Pathfinder internal net radio operator.* Monitors the internal net and keeps the parking party commander informed of inbound aircraft. Relays information to the CC as necessary.

(3) *Signalmen.* Aid in emplacing and operating visual aids and control the movement of aircraft on the ground.

d. Additional Personnel. May be attached as required to—

(1) Assist in the unloading and initial assembly of troops, equipment, and supplies.

(2) Operate assembly aids as directed.

(3) Assist in the preparation of runways, taxiways, parking areas, and the removal or marking of obstacles.

(4) Provide local security and render other assistance as directed.

36. Establishment of an Airplane Landing Strip (figs. 11 and 12)

In establishing an airplane landing strip, each pathfinder element performs the following tasks:

a. Control Center. Prepare radios for operation immediately upon landing. If not changed by actual ground reconnaissance, the CC party moves to its preplanned location. Ideally, the CC should be situated on terrain that permits effective communication and all-round visibility of the control area. Control center personnel compile all information necessary for transmittal to aircraft. As required, they prepare homing beacons, smoke, light guns, and other I. D. codes.

b. Runway Party.

(1) Prepares the pathfinder internal net radio for operation immediately upon arrival at the landing strip. Operators carry their radios at all times in order to maintain constant communication with the CC.

(2) The landing strip commander, with selected personnel, reconnoiters the area as soon as he arrives at the landing strip location. He then selects and points out the exact loca-

tion, direction, and runway alinement to the runway party. The runway party then marks the runway with visual aids. For day operations, the runway is marked with signal panels; for night operations it is marked with lights. Generally, marking of both sides of the runway can be performed simultaneously. However, if a marking priority is required, the left side of the runway is marked first and then the right side.

(3) If necessary and concurrent with marking, the runway party makes hasty improvements to the runway by filling holes and removing brush. It also removes or marks obstacles in the approach and departure zones as promptly as possible. (para 29b (3).)

(4) Pathfinders should be careful not to create obstacles on the runway such as erecting antennas and constructing field fortifications. They should keep personnel and equipment clear of the runway and taxiways in order not to obstruct these areas or to distract aviators.

c. Parking Party. The taxiways, the parking areas, and the dispersal areas are prepared in locations designated by the landing strip commander. The parking party prepares these areas simultaneously with the preparation of the landing area. It removes or marks obstacles and continues to improve and/or maintain the facilities *as long as necessary*.

(1) Since the pilot sits on the left side of most airplanes, the left edge of the taxiway is outlined with panels and/or lights which face aviators as they taxi their aircraft.

(2) A parking point for each aircraft may be marked with a panel and/or light. Aircraft should be parked with the left wing over this panel and/or light. Parking arrangements should be preplanned and coordinated. Extraordinary care must be exercised in securing all panels to the ground. Firmly driven stakes are used to secure panels tautly; rocks piled on the corners of panels *will not* secure the panels properly.

37. Operation of an Airplane Landing Strip

a. General.

(1) Landing and takeoffs by large num-

bers of aircraft may present difficult control problems for pathfinders. Radio discipline must be strictly observed in order to prevent interference with the exchange of messages between the CC and aviators. The CC must exercise the necessary control over aviators and signalmen, but in doing so, it must avoid transmission of unnecessary and confusing radio messages.

(2) The CC pathfinder internal net operator records flight arrival and departure times and the types of loads flown in or out. The radio operator in the parking area transmits the load data to the CC. It may be necessary to send this information by runner to insure communications security.

b. Approach.

(1) Aircraft, singly or in flights, normally approach the landing strip along a designated flight route. Succeeding aircraft or flights follow at time intervals based upon the availability of parking space and the time required to land and clear the landing strip. Individual aircraft landings are separated by a minimum of 30 seconds during the day and 1 minute at night. When departures are interspersed with landings, arriving aircraft should land at intervals separated by a minimum of 1 minute.

(2) Pathfinder controllers can expect single aircraft to approach landing areas from any direction and without using a specified communication checkpoint.

(3) As each flight or single aircraft reaches the communication checkpoint, the flight leader and/or aviator initiates communication with the CC by stating the flight's and/or aircraft's location and number of aircraft, if applicable. The CC provides the aviators with information on the heading to the airstrip (if not already in sight), wind direction and velocity, field elevation, direction of landing, traffic pattern, and any other pertinent information as necessary (app E). Instructions to individual aircraft are prefixed with the call sign of the aircraft. A radio message between the control center and a single aircraft or flight leader (all aircraft monitoring) might be as follows:

Speaker	Topic	Message
Aviator -----	Identification and location --	PATHFINDER CONTROL, THIS IS RAIDER ONE AT CCP; OVER.
Pathfinder at landing strip ----	Acknowledgement -----	RAIDER ONE, THIS IS PATHFINDER CONTROL;
	Heading (from CCP or A/C location, if required), traffic,	HEADING ONE FIVE ZERO, ENTER RIGHT TRAFFIC,
	Direction of landing -----	RUNWAY TWO SIX;
	Wind -----	WIND TWO FIVE ZERO DEGREES AT FOUR; ARTILLERY SOUTH OF THE STRIP FIRING ONE SEVEN ZERO, HEAVY HELICOPTER TRAFFIC ONE MILE EAST OF AIRFIELD, LOW LEVEL, RUNWAY CONDITION
	Other pertinent information (as required), such as enemy situation, friendly fires, traffic conditions, field elevation (at night only), obstacles, condition of runway -----	WET SOD;
	Reporting point -----	REPORT BASE, OVER.
Aviator -----	Confirmation -----	RAIDER ONE, ROGER.

(4) The pathfinder internal net radio operator at the control center informs the parking party that aircraft are inbound.

(5) The flight formation continues along the flight route to the landing strip. If an aircraft or flight cannot locate the landing strip, the control center furnishes additional assistance on request. When the flight approaches

the landing strip, the flight leader designates the order of landing, or if prearranged, insures that the aircraft land in the designated sequence. Each pilot notifies the CC when his aircraft commences its turn to base and/or final leg. Messages transmitted might be as follows:

Speaker	Topic	Message
Aviator -----	Location -----	PATHFINDER CONTROL, RAIDER ONE, TURNING RIGHT BASE.
Pathfinder -----	Acknowledgement -----	RAIDER ONE, PATHFINDER CONTROL,
	Wind -----	WIND TWO FIVE ZERO DEGREES AT FIVE;
	Clearance -----	CLEAR TO LAND;
	Parking instructions -----	TURN RIGHT END OF RUNWAY
Aviator -----	Confirmation -----	RAIDER ONE, ROGER, OUT.

c. *Landing.* Each aircraft lands as directed by the control center and the displayed visual aids.

(1) Visual signals are used in accordance with prearranged plans to assist aviators in routine landings and in emergency situations. If ground-to-air communication fails, landings and takeoffs are controlled by means of visual signals and aids (app F).

(2) Care must be taken not to blind the aviators with smoke or confuse them with unnecessary or unusual signals.

(3) If a situation arises that would endanger the aircraft or make landings hazardous, the pathfinder air traffic controller should keep all airplanes in the air until the landings can be safely accomplished. In the case of enemy action around the airfield, it may be necessary to temporarily clear all airborne aircraft from the immediate area. The controller instructs the aviators by ground-to-air radio and/or emergency visual signals.

d. *Parking.* As each aircraft touches down, the parking party assumes control.

(1) A signalman guides the aircraft from the runway to the taxiway. The aircraft then taxis to the parking area by guiding on the visual aids displayed. On exceptionally rough or unmarked taxiways, it may be necessary for a signalman to lead each aircraft to its parking area.

(2) As each aircraft enters the parking area, a signalman directs it to its designated parking point.

(3) All parking, taxi, and arm-and-hand signals (app F) must be clearly visible (at night lighted batons or flashlights are used) and understandable to aviators. These signals are given from the left front of the airplane. Signalmen must be positioned far enough from the airplane to be in view of the pilot.

(4) When an aircraft has parked, designated personnel from the supported unit take charge of the unloading and initial assembly of the supported troops, equipment, or supplies. Movement and assembly must be performed rapidly and in such a manner that the

runway, taxiways, or parking points will not be blocked. Movement across the runway is not permitted without specific approval of the CC.

(5) Disabled aircraft and aircraft unable to leave on schedule should be moved to a dispersal area if interference with operations is anticipated.

e. Departing. When aircraft are ready to depart, the aviator requests taxi instructions from the pathfinder air traffic controller at the CC. Signalmen may be used to guide the aircraft out of the parking area, and along the taxiway, to a point short of the active runway (the "hold position," two airplane lengths from the active runway). When aircraft are ready for takeoff, the aviator will request takeoff instructions. A departure may be made in a full flight formation, in portion of a flight formation, or by individual aircraft, depending upon the plan and the existing situation. A message sequence might be as follows:

<i>Speaker</i>	<i>Message</i>	<i>Topic</i>
Aviator -----	Taxi instructions -----	PATHFINDER CONTROL, RAIDER ONE, REQUEST TAXI INSTRUCTIONS.
Pathfinder -----	Taxi instructions -----	RAIDER ONE, PATHFINDER CONTROL; WIND TWO ZERO ZERO DEGREES AT FOUR, CLEAR TO TAXI FOR RUNWAY TWO SIX. HOLD SHORT OF ACTIVE RUNWAY, CALL FOR TAKEOFF.
Aviator -----	Confirmation -----	RAIDER ONE, ROGER.
Aviator (hold position) -----	Takeoff instructions -----	PATHFINDER CONTROL, RAIDER ONE, READY FOR TAKEOFF.
Pathfinder -----	Takeoff instructions -----	RAIDER ONE, PATHFINDER CONTROL; WIND TWO ZERO ZERO DEGREES AT FOUR, CLEAR FOR TAKEOFF.
Aviator -----	Confirmation -----	RAIDER ONE, ROGER, OUT.

f. Helicopter Traffic.

(1) *General.* In most tactical situations, airfield controllers can anticipate a large volume of helicopter traffic. They may arrive as single aircraft or as flights. Whenever possible, helicopter landing areas should be planned to expedite traffic and avoid helicopter interference with the operation and safety of the active runway, taxiways, and parking areas.

(2) *Selection of helicopter landing areas.* Selection of helicopter landing areas should be made in conjunction with the supported or using aviation unit. Consideration must be

given to the type of helicopters and the purpose of the landing area, such as medical facilities, rearming and/or refueling points, troop loading and/or unloading areas, and resupply points. The terrain will dictate the size and exact location of these landing areas.

(3) *Marking helicopter landing areas.*

(a) If specific markings are used to designate helicopter landing areas, they will normally be determined by the supported or using aviation unit, and coordinated with the pathfinder site commander.

(b) When special markings are not re-

quired, landing areas may be designated by the use of a reference point (terrain features, relation to the active runway, etc.) Other aids that are used to mark landing areas include signal panels, lights, and smoke. Helicopters should not be allowed to hover near or land directly on signal panels. Lights may mark the landing area and, if coordinated, be arranged to accommodate the exact number and landing formation of the inbound aircraft. When using smoke, care must be taken to insure that its use will not mask any portion of the landing strip. Signalmen are normally not required at this type of helicopter landing site.

(4) *Control of helicopter traffic.*

(a) Inbound helicopters can be controlled by directing the flight to enter the established traffic pattern. When in the traffic pattern, standard procedures will be followed. However, care must be exercised to insure that the speeds of the helicopters are approximately the same as that of the airplane traffic. Preferably, helicopters should not land on, or hover over, the active runway. They should be directed to fly a final approach parallel to the active runway and directly to their landing area.

(b) Helicopters may also be allowed to proceed directly to their designated landing areas without entering the traffic pattern. The information given helicopters directing them to their landing area should insure that they do not present hazards or delays to existing airplane traffic. In this case, helicopters normally approach and depart their landing areas at altitudes well under the established traffic pattern.

(c) Parking within the landing strip will conform to existing safety regulations pertaining to the type of helicopter, the terrain, or the mission. If possible, helicopters should be parked so that the aviator is able to observe the active runway.

Note. Armed helicopters should be parked in such a manner that the weapon systems do not present a hazard to any personnel concentrations, parked aircraft, or facilities at the landing strip.

(d) When departing, singly or in flights of aircraft, aviators request permission from the pathfinder air traffic controller. Helicopters may takeoff in any direction, consistent with safety requirements, in order to expedite air traffic. Clearance to takeoff may be given to helicopters and airplanes concurrently, provided the terrain and situation permit.

CHAPTER 6

DROP ZONES

38. General

A drop zone (DZ) is an area where troops or material are delivered by parachute, or, in the case of certain items, by free drop.

39. Section Capabilities, Organization, and Duties

a. A pathfinder section is organized and equipped to operate three day or night drop zones simultaneously.

b. The pathfinder section is organized to provide a control center (CC) and a marking party for each drop zone. The marking party is further subdivided to—

(1) Prepare and place the panels (lanterns) that form the code letter.

(2) Prepare and place the flank panel (lantern and signal light) and far panel (lantern and signal light).

c. The CC is organized and operated as described in Chapter 3. If considered necessary, the supported aviation unit may establish a release point.

40. Selection of a Drop Zone

a. A drop zone is located where it can best support the ground tactical plan. Factors to be considered in its selection are the—

(1) Type aircraft employed.

(2) Altitude at which air delivery is to be made.

(3) Types of loads to be delivered.

(4) Relative number of obstacles in the area.

(5) Availability of adequate aircraft approach and departure routes.

(6) Method of air drop: free drop, high velocity, or low velocity.

(7) Access to the area.

b. The required length of a drop zone can be computed by using the ground speed of the aircraft and the time needed to release its cargo. The formula is D equals RT ; D is the zone length (distance) in meters, R is the ground speed (rate) of the aircraft in meters per second, and T is the time required for an aircraft to release its cargo. To use this formula, air speed (expressed in knots) must first be converted to ground speed (expressed in meters per second).

Note. When the wind velocity at the delivery altitude cannot be determined, use the aircraft's air speed as the ground speed.

(1) To compute the ground speed when an aircraft is flying into a headwind, subtract the velocity of the headwind from the air speed. For example, an aircraft flying into a 10-knot headwind at an indicated air speed of 110 knots will have a ground speed of 100 knots. To compute the ground speed when an aircraft is flying with a tailwind, add the velocity of the tailwind to the air speed. For example, a 10-knot tailwind plus a 110-knot air speed gives a ground speed of 120 knots.

Note. It is desirable to fly aircraft into the wind during air delivery because the slower ground speed gives more time over the zone and assures a more compact delivery pattern.

(2) To convert knots to meters per second, use the following equation: 1 knot equals 0.51 meters per second. Thus, a ground speed of 100 knots equals 0.51×100 or 51 meters per second.

(3) To calculate the required length of a DZ by using the formula D equals RT and applying the conversions described in (1) and (2) above, proceed as in the following example: An aircraft is flying at a ground speed of 90 knots, and its cargo can be released in

8 seconds. What is the required length of the *DZ*?

R equals 45.9 meters per second (0.51×90
equals 45.9).

T equals 8 seconds

D equals 45.9×8 equals 367.2 meters (rounded
up to 368 M).

c. If a *DZ* of the desired length is not available, the flight time over the zone (whatever its length) must be computed to determine how much of the load can be released in one pass and/or how many passes must be made to release the entire load. The following formula is used: *T* equals *D*/*R*, in which *T* is the time over the *DZ*, *D* is the length (distance) of the *DZ*, and *R* is the ground speed (rate). For example, a field 150 meters long is available as a *DZ*, and an aircraft can release its load at a ground speed of 105 knots or 54 meters per second (0.51×105 equals 53.55 or 54). Applying the formula *T* equals *D*/*R*, 150 divided by 54 equals 2.7 seconds, which is the time over the *DZ*. This figure is then rounded down to the next lower whole second (2.0) to allow for slight delays in initiating the drop.

d. The required width of the *DZ* depends upon the method and/or type of air drop, wind drift, and formation of the aircraft. When using a relatively narrow or small drop zone, it may be necessary to locate the CC (the point over which the drop is initiated) off the actual drop zone to allow for calculated wind drift.

41. Location of Code Letter

a. *General.* The location of the code letter depends upon the size and shape of the *DZ*; the formation, ground speed, and altitude of the aircraft over the *DZ*; and the drift of parachuted loads which, in turn, depends upon the direction and velocity of the wind. The code letter is alined with the long axis of the *DZ* or on a prearranged azimuth. The aircraft fly over the code letter and begin releasing their loads as they come on line with the flank panel. The exact code letter used should be prearranged and coordinated. Code letters will normally be prescribed by unit *SOI*.

b. *Wind Drift Formula.* The wind drift formula, *D* equals *KAV*, is used to determine

the amount of drift of parachutes (in meters) from a given altitude. In this formula, *K* is a constant that represents the characteristic drift of a parachute of a certain model (for all personnel parachutes, *K* is 4.1; for all other parachutes, *K* is 2.6), *A* is the actual drop altitude of the aircraft (in hundreds of feet) over the *DZ*, and *V* is the velocity (in knots) of the surface wind.

(1) An anemometer can be used to measure wind velocity. Some anemometers give readings in knots, and others in miles per hour. Miles per hour is divided by 1.15 to convert to knots, but, for practical purposes, the direct substitution of miles per hour for knots in the wind drift formula gives sufficiently accurate results for winds below 10 knots.

(2) Since each pathfinder will not always have an anemometer available, he must be able to estimate wind velocity with acceptable accuracy. Pathfinders can learn to do this during training by observing the effect of winds of varying strengths on grass, dust, bushes, or small pieces of paper, and then comparing these effects with anemometer readings. (For expedient methods of determining wind velocities, see FM 23-71.)

(3) To illustrate how the wind drift formula (*D* equals *KAV*) is applied, assume that G-13 parachutes are used to drop cargo from an actual altitude of 500 feet in a 10-knot surface wind. Wind drift, then, equals $2.6 \times 5 \times 10$ or 130 meters.

42. Establishment of a Drop Zone

a. *Day Drop Zone* (fig. 13).

(1) The pathfinder site commander selects the exact location for the code letter. He then has the code letter alined on the heading which he desires the aircraft to fly over the drop zone. The assistant site commander supervises the placement of the code letter.

(a) The marking party places the code letter on the ground as shown in figure 13 and elevates the top of the code letter for increased long range visibility.

(b) The flank panel is established parallel to the code letter, with the top of the flank panel alined with the top of the code letter or base panel. The flank panel is placed 200 meters from the left edge of the code letter or at the edge of the *DZ*, whichever is less.

(c) The far panel is established a maximum distance of 500 meters from the code letter or at the end of the drop zone, whichever is less. The far panel will be placed on the desired drop heading, with the panel elevated and in line with the base panel of the code letter.

(2) Concurrently, the CC prepares the ground-to-air radio and the electronic homing beacon (if used) for operation. All electronic aids must be sufficiently separated to prevent mutual electronic interference or simultaneous loss by enemy fire.

b. *Night Drop Zone* (fig. 13). The procedure for establishing a night *DZ* is the same as for a day *DZ* except incandescent lights (or field expedients) are used to mark the code letter, the flank, and the far end of the drop zone. The code letter should be a minimum of 4 lights high, 3 lights wide, with 5 meters between lights. Light guns are located at the CC, flank, and far panel.

c. *Detecting DZ's*. In heavily vegetated terrain, *DZ's* may be difficult to locate from the air. Electronic homing beacons are especially useful in such terrain. Expedient methods such as balloons and pyrotechnics may also be used to assist aircraft in locating and identifying *DZ's*. In situations where secrecy is of prime importance, aircraft equipped with automatic direction finding (*ADF*) equipment can conduct drops using only the radio homing beacon, without the aid of radio control or visual markings.

43. Operation of a Drop Zone

a. Aircraft may approach the *DZ* either as single aircraft or in flights. As a single aircraft or flight reaches the communication checkpoint, the pilot or flight leader informs the CC of his position and includes additional information, as necessary, concerning the number and type(s) of aircraft and types of loads. The CC provides the aviators the magnetic heading (vector) from the communication checkpoint to the *DZ*, the drop altitude (indicated), and any other pertinent information necessary. The altitude (indicated) prescribed for the aviators by the CC must be high enough to guarantee adequate clearance of all obstacles in the flight path. The flight leader ac-

knowledges receipt of the message and complies with the instructions received.

b. In certain areas, long range visibility may be restricted by tall trees. When dropping in such areas at altitudes of 500 feet (actual) or less, it may be necessary for the pathfinder to require the drop aircraft to maintain a higher altitude enroute from the CCP in order to allow for establishment of long range visual contact. The aircraft is then directed to descend to the prescribed drop altitude at the proper time in order to allow a safe approach and correct delivery.

c. As the lead aircraft comes into view, the CC gives the aviator verbal instructions to guide the aircraft over the code letter, alerts him as he nears it, and directs him when to release his load. Trailing aircraft follow the movements of the lead aircraft as closely as possible and listen for corrective instructions from the CC.

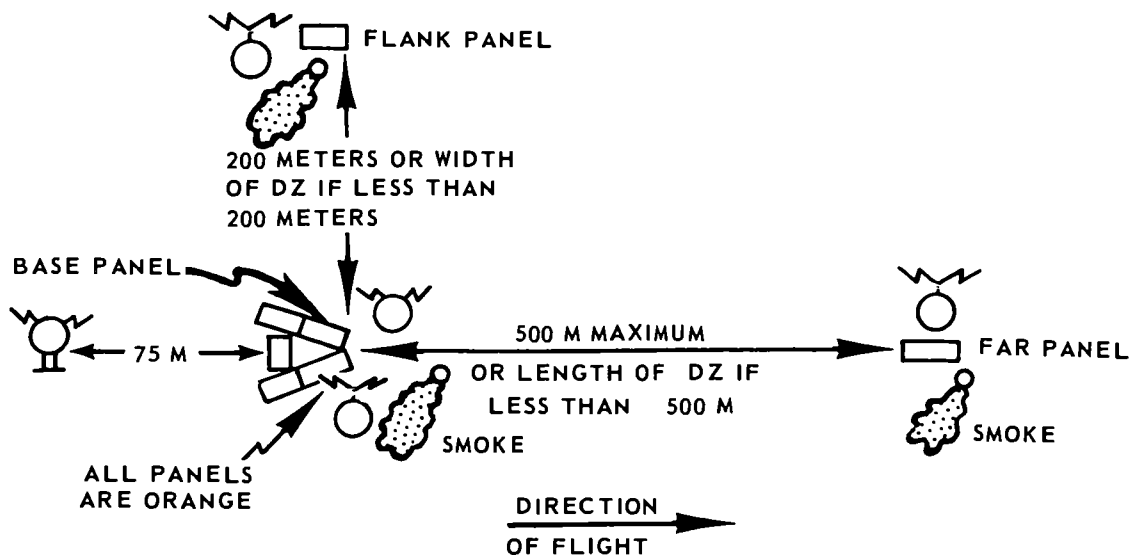
d. In an extremely restricted *DZ*, it may be necessary for each aircraft to make several passes, releasing a part of its load on each pass. The only formation flown in this situation is single aircraft in trail. The CC directs the aircraft to fly over the *DZ* in a continuous "racetrack," using either a left- or right-hand traffic pattern (app E). Since the aviators of aircraft in trail can usually follow the lead aircraft quite accurately, the CC seldom has to give individual instructions until shortly before each aircraft is in position to drop its load.

44. Example of Drop Zone Guidance Procedure

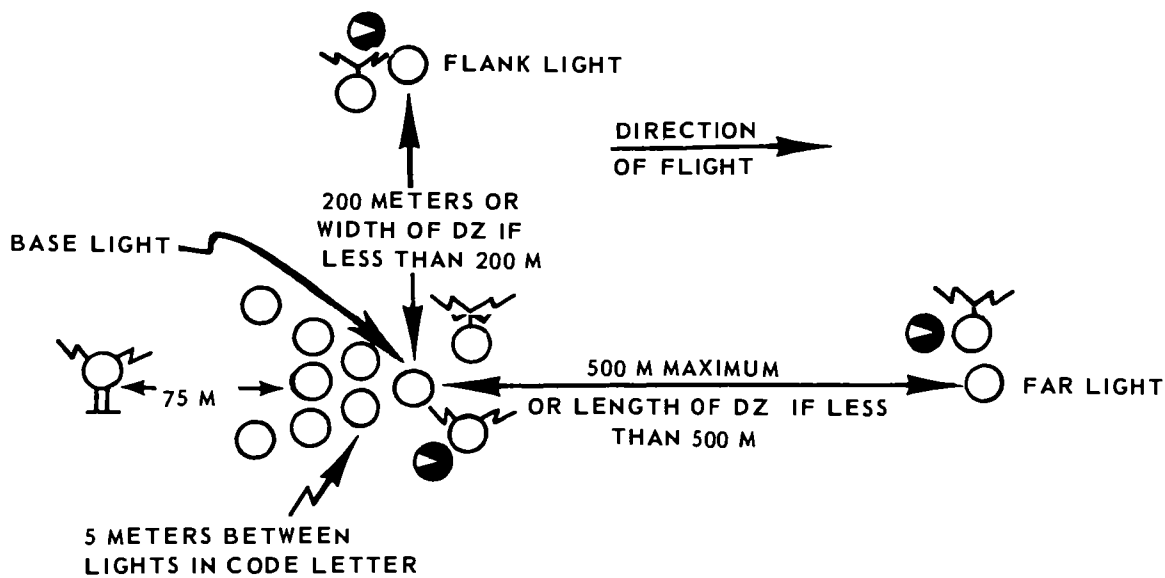
a. General.

(1) When the aircraft come into view, the ground-to-air radio operator must keep them under constant observation in order to guide them correctly over the *DZ*. The aircraft must be flying high enough to allow the controller to maintain continuous visual contact with the aircraft.

(2) Initially, the pathfinder gives instructions only to the flight leader, but all aviators in the flight monitor the messages and follow the actions of the leader. When the pathfinder controller needs to give instructions to individual aircraft, he prefaces the instructions with the call sign of the aircraft concerned.



DAY



NIGHT

NOTE: WHITE LIGHTS ARE PREFERABLE; BLUE OR GREEN LIGHTS ARE DIFFICULT TO DETECT FROM RANGE.

NOTE: SEE FIGURES 11 & 12 FOR SYMBOL LEGEND

Figure 13. Day and night drop zone.

(3) If ground-to-air radio communication fails while the CC is providing guidance, all aviators continue their missions, using visual aids on the ground to assist in making correct approach and delivery. In such situations the aviator will align the aircraft with the code letter and the far panel. Smoke (or a light gun at night) may be used at each location as a long range visual aid to assist the aviator in aligning his aircraft on the *DZ*. As the left wing comes abeam of the flank panel (light), the aviator will release the load. At night, the light gun located at the flank light may be used to flash the drop signal to the aircraft as it arrives over the code letter. If a "no-drop" condition exists, the CC will—

(a) Transmit a verbal "no drop" (repeated at least three times) to the aircraft over the ground-to-air radio.

(b) Display red side of panels during day operations, time permitting.

(c) Display no visual aids (day or night), time permitting.

(d) Use precoordinated visual signals, to include pyrotechnics or lights.

b. *Guidance for a Drop.* Guidance procedures for a drop might be as follows:

(1) *For a straight-in approach to the DZ from the CCP.*

Flight leader: *DZ CONTROL, THIS IS REDHAWK 112 WITH A FLIGHT OF SIX AT CCP, OVER.*

DZ control: REDHAWK 112, THIS IS DZ CONTROL; DROP HEADING ZERO FOUR FIVE, DROP ALTITUDE ONE THOUSAND FIVE HUNDRED INDICATED, CONTINUE APPROACH FOR VISUAL GUIDANCE, OVER.

Flight leader: 112, ROGER.

As aircraft comes into sight and approaches the drop zone, the *DZ control* will contact the aircraft and proceed as follows:

DZ control: REDHAWK 112, DZ CONTROL; STEER RIGHT (LEFT), (OR STEER HARD) RIGHT (LEFT).

DZ control: 112, ON COURSE (given after each steering command)

DZ control: 112, STANDBY (given

from five to ten seconds before the drop should commence).

DZ control: 112, EXECUTE! EXECUTE! EXECUTE!

Note. The flight leader will execute the air delivery and maintain his drop heading until he clears the drop zone. Should other aircraft in the flight veer off the desired course prior to or during the drop, individual steering commands can be given. Each aircraft will be given "standby" and the command to drop by the CC. The command "EXECUTE" is given until a response is seen or conditions are no longer safe to drop. The command "NO DROP" will be given by the CC when an unsafe condition exists on the drop zone or the aircraft is improperly aligned over the code letter to the degree that the load would not land on the *DZ*.

(2) *For approach to the DZ other than straight-in from CCP*

Aviator: *DZ CONTROL, THIS IS REDHAWK 220 AT CCP, OVER.*

DZ control: REDHAWK 220, THIS IS DZ CONTROL; HEADING ZERO FOUR FIVE, DROP ALTITUDE SEVEN HUNDRED INDICATED; MAINTAIN ONE THOUSAND FIVE HUNDRED INDICATED UNTIL I HAVE YOU IN SIGHT, OVER.

Aviator: REDHAWK 220, ROGER. As aircraft come into sight and approach the required drop heading, the CC will contact the aircraft and proceed as follows:

DZ control: REDHAWK 220, DZ CONTROL; TURN LEFT TO HEADING THREE SIX ZERO: DESCEND TO SEVEN HUNDRED INDICATED.

Aviator: 220, ROGER.

DZ control: 220, STEER RIGHT (LEFT), OR STEER HARD RIGHT (LEFT).

DZ control: 220, ON COURSE (given after each steering command).

DZ control: 220, STANDBY.

DZ control: 220, EXECUTE! EXECUTE! EXECUTE!

(3) *For a drop utilizing a traffic pattern.*

Aviator: *DZ CONTROL, THIS IS REDHAWK 178 AT CCP, OVER.*

DZ control: REDHAWK 178, THIS

IS *DZ* CONTROL; HEADING ZERO FOUR FIVE, DROP ALTITUDE ONE FIVE FIVE ZERO INDICATED; TWO BUNDLES PER PASS, CONTINUE APPROACH FOR VISUAL GUIDANCE, OVER. Aviator: REDHAWK 178, ROGER. As aircraft come into sight and approach the required drop heading, the *DZ* control will contact the aircraft and proceed with the following: *DZ* control: REDHAWK 178, *DZ* CONTROL; TURN LEFT TO HEADING ZERO ONE ZERO.

Aviator: 178, ROGER.

DZ control: 178, STEER LEFT (RIGHT).

DZ control: 178, ON COURSE (given after each steering command).

DZ control: 178, STANDBY.

DZ control: 178, EXECUTE! EXECUTE! EXECUTE!; ENTER LEFT (RIGHT) TRAFFIC, REPORT FINAL.

Avator: 178, ROGER.

APPENDIX A

REFERENCES

ACP-168	Allied Communications Publications Pyrotechnic Signals.
AR 95-Series	Aviation.
AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 350-1	Army Training.
AR 380-5	Safeguarding Defense Information.
AR 385-10	Army Safety Program.
AR 735-35	Supply Procedures for TOE and TDA Units or Activities.
AR 750-5	Organization, Policies, and Responsibilities for Maintenance Operators.
AR 750-8	Command Maintenance Management Inspections.
ASubjScd 1-1	Aerial Navigation.
ASubjScd 7-50	Air Movement Training.
ATT 7-168	Pathfinder Detachment.
DA Pam 108-1	Index of Army Films, Transparencies, GTA Charts, and Recordings.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, Supply Bulletins, Lubrication Orders and Modification Work Orders.
DA Pam 310-7	U.S. Army Equipment Index of Modification Work Orders.
DA TOE's	"G" Series.
JCS PUB 1	Dictionary of U.S. Military Terms for Joint Usage (JC).
FM 1-5	Aviation Company.
FM 1-10	Army Aviation Organizational Aircraft Maintenance.
FM 1-15	Divisional Aviation Battalion and Group.
FM 1-60	Army Aviation Air Traffic Operations—Tactical.
FM 1-80	Aerial Observer Training.
FM 1-100	Army Aviation Utilization.
FM 1-105	Army Aviation Techniques and Procedures.
FM 1-110	Armed Helicopter Employment.
FM 3-10	Employment of Chemical and Biological Agents.
FM 5-15	Field Fortifications.
FM 5-25	Explosives and Demolitions.
FM 6-20-2	Field Artillery Techniques.
FM 6-135	Adjustment of Artillery Fire by the Combat Soldier.
FM 7-11	Rifle Company, Infantry, Airborne and Mechanized.
FM 7-15	Rifle Platoon and Squads, Infantry, Airborne and Mechanized.
FM 7-20	Infantry, Airborne Infantry and Mechanized Infantry Battalions.
FM 7-24	Communications in Infantry and Airborne Divisions.
FM 7-30	Infantry, Airborne and Mechanized Division Brigades.
FM 17-36	Divisional Armored and Air Cavalry Units.
FM 21-5	Military Training Management.

FM 21-6	Techniques of Military Instruction.
FM 21-11	First Aid for Soldiers.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 21-31	Topographic Symbols.
FM 21-40	Chemical, Biological and Nuclear Defense.
FM 21-60	Visual Signals.
FM 21-75	Combat Training of the Individual Soldier and Patrolling.
FM 21-76	Survival.
FM 21-77	Evasion and Escape.
FM 22-100	Military Leadership.
FM 23-71	Rifle Marksmanship.
FM 24-1	Tactical Communications Doctrine.
FM 24-18	Field Radio Techniques.
FM 30-5	Combat Intelligence.
FM 31-16	Counter guerrilla Operations.
FM 31-20	Special Forces Operational Techniques.
FM 31-21	Special Forces Operations.
FM 31-22	U.S. Army Counterinsurgency Forces.
FM 31-30	Jungle Training and Operations.
FM 31-72	Mountain Operations.
FM 31-73	Advisor Handbook for Stability Operations.
FM 54-2	The Division Support Command.
FM 57-1	U.S. Army/U.S. Air Force Doctrine for Airborne Operations.
FM 57-10	Army Forces in Joint Airborne Operations.
FM 57-35	Airmobile Operations.
FM 57-100	The Airborne Division.
FM 61-100	The Division.
TC 21-4	Rappelling from Helicopters.
TM 1-225	Navigation for Army Aviation.
TM 1-260	Rotary Wing Flight.
TM 1-300	Meteorology for Army Aviation.
TM 5-330	Planning, Site Selection, and Design of Roads, Airfields, and Helicopters in the Theater of Operations.
TM 5-366	Planning and Design for Rapid Airfield Construction in the Theater of Operations.
TM 6-20-2	Field Artillery Techniques.
TM 9-1370-200	Military Pyrotechnics.
TM 10-500 Series	Air Drop of Supplies and Equipment.
TM 11-2557-27	Air Traffic Control Procedures Manual.
TM 11-5820-348-15	Organizational, DS, GS, and Depot Maintenance Manual: Antenna Equipment RC-292.
TM 11-5820-398-12	Organizational Maintenance Manual: Radio Set AN/PRC-25.
TM 11-5820-498-12	Organizational Maintenance Manual: Radio Sets AN/VRC-53, AN/GRC-125, w/amplifier, Power Supply Group OA 3633/GRC.
TM 11-6660-232-15	Operator Organizational, DS, GS, and Depot Maintenance Manual incl. Repair Parts and Special Tool Lists: Wind Measuring Sets AN/PMQ-3, 3A, 3B, 3C.
TM 11-6665-213-12	Operator and Organizational Maintenance Manual Radiacmeter IM-174/PD.
TM 11-6665-214-10	Operator's Manual: Radiacmeters IM-9E/PD, IM-93/UD, IM-93A/UD, and IM-147/PD.

TM 55-601	Troop Movement Guide.
TM 55-450-8	Air Transport of Supplies and Equipment: External-Transport Procedures.
TM 55-450-9	Air Transport of Supplies and Equipment: Internal-Transport Procedures.
TM 55-1520-209-10CL	Army Model CH-47A Helicopter Pilot's Checklist.
TM 55-1520-210-10	Army Model UH-1D/H Helicopter.
TM 55-1520-218-10	Operator's Manual: Army Model UH-1A Helicopter.
TM 55-1520-219-10	Operator's Manual: Army Model UH-1B Helicopter.
TM 55-1520-220-10	Operator's Manual: Army Model UH-1C Helicopter.
TM 57-210	Air Movement of Troops and Equipment.
TM 57-220	Technical Training of Parachutist.

APPENDIX B

OPERATION FORMATS

1. General

The formats described herein may be used to facilitate planning and accomplishment of pathfinder operations. These formats are intended as a *guide* and should be modified as required.

2. Operation Planning Format

a. *Purpose.* The pathfinder commander uses this format (fig. 14) in organizing his unit for an operation. It consolidates information pertinent to each individual or element, and the commander can use it as a reference during his planning and briefing for an operation.

b. *Explanation of Headings.*

(1) *Acft. no.* The chalk number or the last three digits of the tail number of the aircraft in which the individual will be transported.

(2) *Name.* The name of the pathfinder.

(3) *Load time.* The time the pathfinder must be loaded on the aircraft with all his equipment.

(4) *T/O time.* The takeoff time is when the aircraft will depart the staging area.

(5) *Duty and location.* The job assignment and location within the operational area for each pathfinder.

(6) *Call sign & freq.* The radio call sign and frequency for those individuals operating radios.

(7) *Equipment.* Equipment, other than individual equipment, that each pathfinder element will carry for the operation.

(8) *Remarks.* Any other pertinent information necessary.

3. Landing and/or Drop Zone Control Records

a. *Purpose.* This format (fig. 15) may be

used to maintain a record of aircraft arrivals, departures, and type loads. It serves as a source of information for both ground and aviation commanders, aids in accounting for personnel and equipment, and may be instrumental in initiating or assisting in search and rescue operations for overdue or downed aircraft. It is normally maintained by the pathfinder internal net radio operator at the CC.

b. *Explanation of Headings.*

(1) *Format heading.*

(a) *Pathfinder unit.* Coded or number designation.

(b) *Supported unit.* Principal ground unit or aviation unit designation.

(c) *Period.* Date and time operation commences until termination of operation or end of the day; 0001 until 2400 hours on succeeding days or until completion of operation.

(d) *Operation.* Name or number of operation.

(e) *LZ, Afld, DZ.* Cross out items not applicable, and add any special designation used.

(f) *Recorder.* Name of person who has recorded data on the form.

(2) *Column headings.*

(a) *Flight or aircraft number.* Radio call sign of the flight or aircraft.

(b) *Type aircraft.* Army or Air Force model designation.

(c) *Time communication established.* Time aircraft acknowledges contact (radio or visual, as applicable).

(d) *Time.*

1. *Arrival.* Time aircraft or first of flight lands.

2. *Departure.* Time aircraft or last of flight has wheels up.

(e) *Type load.*

(Classification)

PATHFINDER OPERATION PLANNING FORMAT

ACFT NO	NAME	LOAD TIME	T/O TIME	DUTY AND LOCATION	CALL SIGN & FREQ	EQUIPMENT	REMARKS
N A	GILLEM	N A	N A	SECTION CO, STAGE FLD DEKKAR STRIP, GL 934730	BLACKHAT 6, 34.50	4-PRC 25 RADIOS 24-V5 17 PANELS 35-MX 290 LANTERNS 3 SETS OF BATONS 1-SE 11 LIGHT GUN 1-ML 433 ANEMOMETER 3 COLORED JACKETS EXTRA SMOKE	BE PREPARED FOR MIXED TRAFFIC AND NIGHT OPNS UNTIL RELIEVED.
N A	CARO	N A	N A	G A RTO, STAGE FLD	DEKKAR CONTROL, 34.50		
N A	SCHRADER	N A	N A	INT NET RTO, STAGE FLD	CC, 66.20		
N A	GREENE	N A	N A	SIGNALMAN, STAGE FLD	PARK, 66.20		
N A	CRANFIELD	N A	N A	SIGNALMAN, STAGE FLD	HOT SPOT, 66.20		
750	FULLERTON	0540	0545	SITE CO, LZ ALBANY GL 055713	BLACKHAT 1, 40.20	2-PRC/25 RADIOS 12-MX/290 LANTERNS 1-SE/11 LIGHT GUN 1 SET OF BATONS 6-V5/17 PANELS 1-ML/433 ANEMOMETER 8 SMOKE GRENADES	ACCOMPANY A 1-188TH ON SEARCH & DESTROY OPERA- TION UNTIL COMPLETED.
750	CLAREY	0540	0545	G A RTO, LZ ALBANY	ALBANY CONTROL, 40.20		
750	STRICKER	0540	0545	PFDR, LZ ALBANY	N/A		
777	ELLIS	0535	0540	SITE CO, LZ MACON GL 075720	BLACKHAT 2, 51.30	SAME AS FOR LZ ALBANY	ACCOMPANY B 1-188TH ON SEARCH & DESTROY OPERA- TION UNTIL COMPLETED.
777	MOORE	0535	0540	G A RTO, LZ MACON	MACON CONTROL, 51.30		
777	COGGINS	0535	0540	PFDR, LZ MACON	N/A		
N A	HOFFMAN	N/A	N/A	SITE CO, STANDBY RE- SERVE VIC DEKKAR STRIP	BLACKHAT 3, 37.30	SAME AS FOR LZ ALBANY	REMAIN WITH C 1-188TH (RESERVE) AT DEKKAR STRIP, COMMITTED ON ORDER. *CALL SIGN WILL CORRESPOND WITH NAME OF LANDING SITE IF RESERVE IS COMMITTED.
N A	WELCH	N/A	N/A	G A RTO, STANDBY RESERVE	37.30*		
N A	MURRAY	N/A	N/A	PFDR, STANDBY RESERVE	N/A		
N A	BLIZZARD	N/A	N/A	R & R			

SUPPORTED UNIT: 1-188TH INF.

LIFT UNIT: A 21ST AVN BN

ACL: 8 PAX

LZ TIME: 31 0600 MAR

DACO: 53 AIR, 1-188TH INF, DEKKAR STRIP

TYPE ACFT: UH-1D

ARTY PREP AT LZ MACON & ALBANY COMMENCES

H-20 MIN; LIFTED H-5 MIN

ARTY PREP FIRED FROM GL 035725

CCP: GL 956696

RP: GL 015692

1-188TH INF: RIGHT HALF, 47.00

A 21ST AVN BN: DEADLY SERPENT, 39.00

PATHFINDERS: DEKKAR CONTROL, 34.50

ALBANY CONTROL, 40.20

MACON CONTROL, 51.30

RESERVE, 37.30

SIGNAL

(Classification)

Figure 14. Operation planning format.

PATHFINDER UNIT:
SUPPORTED UNIT:
PERIOD:
OPERATION: (AFLD, LZ, DZ)

21ST AVN BN PFDR SECT
1-188TH INF
210001-212400 MARCH
MASHER
(NAME OR LOCATION OF SITE)
PFC ROY S. COBB

RECORDER:

FLT OR ACFT NO	TYPE ACFT	TIME COMM ESTAB	TIME		TYPE LOAD		REMARKS
			ARR	DPRT	DELIVERED	EVAC	
(EXAMPLE FOR AIRFIELD OPERATION)							
MUDDY 750	U-1A	0600	0610	0625	RATIONS	2WIA	DAMAGED PROPEL- LER; TO DISPERSAL AREA.
MUDDY 882	U-1A	0605	0615		AMMUNITION		
DIXIE 21	C-123	0610	0620	0635	AMMUNITION	4WIA	
(EXAMPLE FOR DROP ZONE OPERATION)							
YANKEE III	C-7A	1705	1710		3 BUNDLES-AMMO		ABORTED TWO MILES OUT.
MUDDY 334	U-6A	1715	N/A				
MUDDY 678	U-6A	1720	1725		3 BUNDLES-RATIONS		
(EXAMPLE FOR HELICOPTER LANDING SITE OPERATION)							
YELLOW 1	UH-1D	1230	1235	1236	PERSONNEL		CONTACTED CC WITH A FLIGHT OF FOUR
YELLOW 2	UH-1D	1230	1235	1236	PERSONNEL		
YELLOW 3	UH-1D	1230	1235	1236	PERSONNEL	4WIA	
YELLOW 4	UH-1D	1230	1235	1236	MORTAR AMMO		
PANTHER 167	CH-47	1245	1250	1252	AMMUNITION		
APACHE 921	CH-54	1300	1305	1307	N/A	1 UH-1D	

Figure 15. Landing and/or drop zone control record (sample extract).

1. *Delivered.* Supplies, equipment, or personnel delivered.

2. *Evacuated.* Supplies, equipment, or personnel evacuated.

APPENDIX C

CHECKLIST FOR PATHFINDER OPERATIONS

Upon receipt of an order to conduct a pathfinder operation, the pathfinder commander follows, to the extent possible, the troop leading procedures listed below:

a. Issue section warning order to include—
(1) A brief statement of the enemy and friendly situation.

(2) Mission of the section.

(3) Uniform and individual equipment; team and special equipment.

(4) Work priority for preparation of team equipment (normally SOP).

(5) Issue of rations, ammunition, and special equipment.

(6) Breakdown of section personnel.

(7) Time and place for the section to receive the operation order.

b. Make tentative plan of operation to include the following:

(1) Study map.

(2) Check weather.

(3) Study unit *SOI*.

(4) Make a quick estimate of the situation.

(a) Requirement for additional personnel from supported unit.

(b) Requirement for additional equipment or material.

(c) Communications requirements.

(5) Begin planning.

c. Arrange for—

(1) Movement of unit (informs second in command).

(2) Coordination (with ground and aviation units).

(a) Ground tactical plan.

(b) Landing and unloading plan.

(c) Air movement plan.

(d) Loading plan.

(3) Additional personnel or equipment, if any, from supported units.

d. From the above, prepare tentative operational plan for the pathfinder section.

e. Make reconnaissance when time permits. Continue estimate and receive recommendations.

f. Complete plan (work out details, formulate orders).

(1) Present tentative plan to supported unit commander or his staff.

(2) Prepare final plan based on desires of supported unit commander and his final order.

g. Issue section order (normally an oral order).

h. Join supported units.

i. Rehearse (if time and terrain permit).

APPENDIX D

AERIAL NAVIGATION STRIP MAPS

1. General

Aerial navigation strip maps can be used as map substitutes and as a systematic method for planning and study of flight routes. A sample strip map is shown in figure 16.

2. Elements of Aerial Navigation Strip Maps

All aerial navigation strip maps should contain the following eight elements:

a. *Checkpoint Number.* The numbering or lettering in sequence of checkpoints.

b. *Identification of Checkpoint.* A simple word description of the checkpoint.

c. *Sketch.* A simple sketch of what the checkpoint will look like as the aircraft flies over it.

d. *Distance.* The distance between checkpoints in nautical miles measured on a map to the nearest half mile.

e. *Magnetic Heading.* The magnetic heading in degrees from one checkpoint to the next.

f. *Flight Speed.* The speed in knots that the aircraft is to fly from one checkpoint to the next. This is usually the cruising speed of the aircraft.

g. *Altitude (indicated).* The altitude as indicated on the aircraft's altimeter. Indicated altitude includes ground elevation.

h. *Time.* The time rounded off to the nearest minute between checkpoints. The time is computed by using the formula in paragraph 4 below.

3. Preparation

In preparing aerial navigation strip maps, con-

sideration must be given to the following factors:

a. Checkpoints must be easily recognizable from the air.

b. Time between checkpoints should be relatively uniform. As the aircraft gets closer to the landing and/or drop zone, the checkpoints should be closer together to insure accuracy of navigation.

4. Formulas

The formulas used in computing time and distance are as follows:

$$a. \text{ Time: } T = \frac{D \times 60}{R}$$

T = Time

D = Distance

60 = Constant

R = Rate (speed) of aircraft in knots.

Example: Distance: 10 nautical miles

Rate: 90 knots

$$\frac{10 \times 60}{90} = \frac{600}{90} = 6.6 = 7 \text{ minutes}$$

Note: Round time off to nearest whole minute.

$$b. \text{ Distance: } D = \frac{R \times T}{60}$$

Rate: 90 knots

Time: 10 minutes

$$\frac{90 \times 10}{60} = \frac{900}{60} = 15 \text{ nautical miles}$$

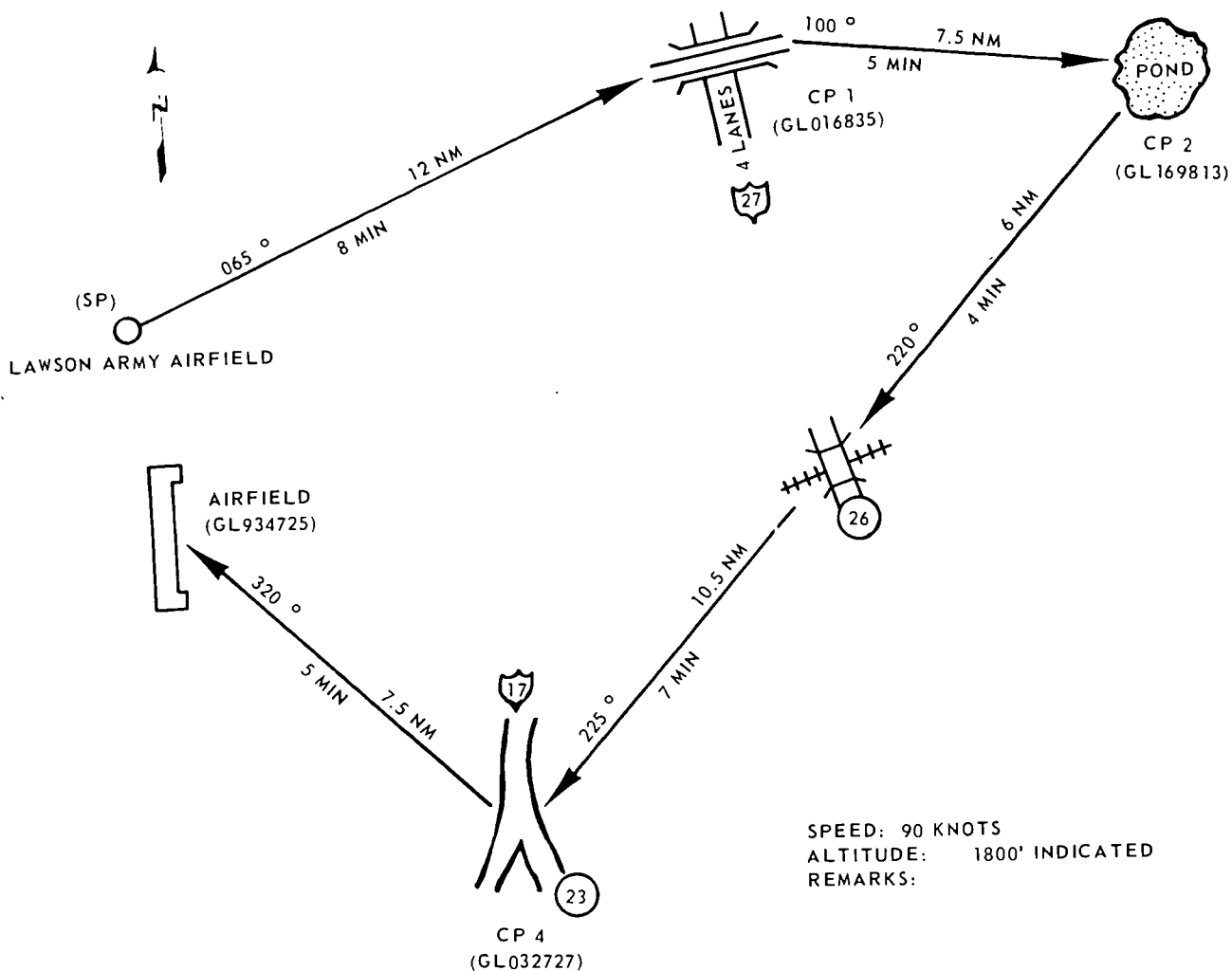


Figure 16. Sample aerial navigation strip map.

APPENDIX E

AIR TRAFFIC CONTROL

1. General

a. The purpose of air traffic control is to prevent collisions, expedite traffic, provide flight information, and aid in search and rescue.

b. Pathfinders, as air traffic controllers, provide control service based only upon observed or known traffic and airfield conditions which might, in their judgment, constitute a hazard. These conditions include surface conditions, parachutists within control zones, vehicular traffic, temporary obstructions on or near the airfield, other aircraft, and enemy or friendly activities.

(1) They issue by radio or directional light signals, specific approval or disapproval for movement of vehicles, equipment, or personnel on the movement area.

(2) If traffic conditions permit, they issue clearances, instructions, and information necessary for the safe and orderly flow of traffic under their jurisdiction.

c. Pathfinders are charged with the responsibility for maintaining a continuous surveillance of all visible air traffic operating within the control zone of the landing drop zone or airfield. They are also responsible for all aircraft, vehicles, and personnel in the movement area of the landing and/or drop zone or airfield.

d. Since it is impossible to list procedures to cover all traffic situations, it is essential that the air traffic controller develop knowledge, speed, and accuracy, which are the results of application, study, experience, and good judgment. In air traffic control, there can be no substitute for these three elements.

e. Definitions of terms peculiar to air traffic control are included in the glossary.

2. Communications

a. Because communication is the basic tool of air traffic control, words must be used as effi-

ciently and accurately as possible. The pathfinder and the pilot must be good speakers as well as listeners to accomplish good communication. A clear and decisive tone of voice is the best indication that the situation is well in hand. When a pathfinder sounds vague and hesitant, the traffic flow may follow the same pattern; pilots may be hesitant in following instructions which would not facilitate the safe and orderly flow of traffic that is desired. A firm, confident voice and the use of standard phraseology are prerequisites of good control.

b. Conversations must be brief, concise, unhesitating, and in a uniform flow of language. Every effort must be made to enunciate clearly and distinctly, paying special attention to numerals. Use of such words as "guess" and "think" is undesirable since they are vague and indecisive. When doubt exists concerning the accuracy of the received message, the complete message or the essential parts should be repeated.

c. The phonetic alphabet is used to indicate single letters, initials, or for spelling words whenever similar sounds or difficulties in communication make such use necessary.

d. Transmissions should be concise and in normal conversational tone. Rate of speech may be rapid when the situation demands it, providing the enunciation is distinct. However, the speed must never result in the need for repeated transmissions. The following may be used as a guide to good operating techniques for radiotelephone communications:

- (1) Speak directly into the microphone.
- (2) Speak in normal conversational tone.
- (3) Avoid monotonous pitch.
- (4) Avoid a too slow or too fast rate of speech.
- (5) Avoid any display of emotion, nervousness, indecision, or excitement.

(6) Above all, *speaking with confidence*, especially during emergency situations in order to instill confidence in others.

e. Transmit only those messages necessary for air traffic control or otherwise contributing to air safety. Specified procedures and control techniques vary, but the following basic rules apply regardless of the techniques that are used:

(1) The pathfinder is responsible for issuing instructions and information relative to all known traffic conditions.

(2) All turns by the pilot around the landing strip will be left-hand, unless otherwise specified by the pathfinder.

(3) At least one component of a standard traffic pattern (final approach) will be used by the pilot, consistent with instructions issued by the pathfinder.

(4) Pilots have the final authority for the acceptance of clearances issued by a controller.

f. Initiate radio communication with an aircraft by using the following format:

(1) Initial call-up of an aircraft by ground control.

(a) Identification of the aircraft being called.

(b) The words THIS IS.

(c) Identification of the calling unit.

(d) The type of message to follow, when this will assist the pilot.

(e) The word OVER.

Example. FRESNO TILES 112, THIS IS ALFA CONTROL; OVER.

(2) Replying to initial call-up from aircraft.

(a) Identification of aircraft initiating the call-up.

(b) The words THIS IS.

(c) Identification of the replying unit.

(d) The word OVER.

Example. FRESNO TILES 112, THIS IS ALFA CONTROL; OVER.

(3) Always preface a clearance of instruction intended for a specific aircraft with the identification of that aircraft.

Example. FRESNO TILE 112, CLEAR TO TAXI.

(4) Shorten transmissions as follows when no confusion is likely:

(a) Use only the last three digits or letters of aircraft identification after commu-

nications have been established and the type of aircraft is known.

Example. 112, CLEAR TO LAND.

(b) Omit the words THIS IS from call-up or reply.

Example. 112, ALFA CONTROL; OVER.

(c) Omit the facility identification after communications have been established.

Example. 112, TURN TO HEADING 045; OVER.

(d) Transmit a message immediately after call-up (without waiting for aircraft reply) when it is short and receipt is generally assured.

Example. 112, EXTENDED DOWNWIND.

(e) Omit the word OVER if the message obviously requires a reply.

Example. 112, WHAT'S YOUR LOCATION.

(5) Emphasize appropriate digits, letters, or words to distinguish between similar aircraft identifications.

g. During the final approach, touchdown, landing roll, takeoff and initial climb, and turn-away from the field, it is of the utmost importance that the pilot give his undivided attention to flying the aircraft. For this reason, the controller should *refrain* from transmitting to him during these phases of operation. However, any observed condition or known information which may affect safety of flight is transmitted at any time. *Under no circumstance* is information pertaining to hazardous runway, field, weather, or traffic conditions withheld from the pilot of an approaching aircraft.

3. Use of Numbers in Air Traffic Control Operations

a. Figures indicating hundreds and thousands in round numbers, as for ceiling heights and flight altitudes, will be spoken in accordance with the following examples:

Examples.

500—Five hundred (or five zero zero, for additional emphasis).

1,300—One thousand three hundred.

11,495—One one four niner five.

b. State the word TIME, followed by the digits specified:

Examples.

<u>Time (12 hr)</u>	<u>Time (24 hr)</u>	<u>Statement</u>
1:15 A.M.	0115	TIME, ZERO ONE ONE FIVE
1:15 P.M.	1315	TIME, ONE THREE ONE FIVE

c. State field elevations in feet in accordance with the following:

Examples.

<u>Elevation</u>	<u>Statement</u>
17 feet	FIELD ELEVATION ONE SEVEN
583 feet	FIELD ELEVATION FIVE EIGHT THREE

d. The number "0", except where it appears in group form, state the word ZERO.

e. State the word WIND, followed by the indicated wind direction; the words DEGREES AT, and the indicated velocity in knots.

Example. WIND 270° AT 5.

f. State the word HEADING, followed by the three digits of the number of degrees and omit the word DEGREES. Use HEADING 360 to indicate a north heading.

Example. HEADING 120
HEADING 005

4. Phraseology

Phraseology is a manner of expressing air traffic control terminology. Familiarity with the following phrases is essential in order to adequately talk to and control aircraft:

a. To issue takeoff clearance when a delay is not desired.

Example. CLEARED FOR IMMEDIATE TAKEOFF.

b. To issue takeoff clearance when aircraft is delaying on the runway.

Example. TAKEOFF IMMEDIATELY OR TAXI OFF THE RUNWAY.

c. Pilot requesting straight-in approach (after landing instructions have been issued).

Example. ALFA CONTROL THIS IS MUDDY 750, REQUEST STRAIGHT-IN APPROACH TO RUNWAY 18.

d. Pathfinder authorizing straight-in approach.

Example. MUDDY 750, STRAIGHT-IN APPROACH TO RUNWAY 18 APPROVED.

e. Pathfinder authorizing right-hand traffic pattern.

Example. MUDDY 750, RIGHT TRAFFIC APPROVED.

f. Pathfinder issuing a landing sequence.

Example. MUDDY 750, YOU'RE NUMBER THREE TO LAND; FOLLOW U-6 385 ON DOWNWIND.

g. Pathfinder instructing an aircraft to extend downwind leg in order to obtain necessary aircraft separation:

Example. MUDDY 750, EXTEND DOWNWIND.

h. Pathfinder advising an aircraft of pertinent information not included in landing instructions.

Example. MUDDY 750, BE ADVISED WE ARE RECEIVING AUTOMATIC FIRE FROM THE EAST.

i. Pathfinder trying to ascertain the identification of an aircraft in his area.

Example. UH-1 ONE MILE WEST OF DEKKAR STRIP, SAY ID.

j. Pathfinder instructing an aircraft to circle the field.

Example. MUDDY 750, CIRCLE THE FIELD.

k. Pathfinder issuing clearance to land.

Example. MUDDY 750, CLEAR TO LAND.

l. Pathfinder instructing an aircraft on final landing that clearance has been cancelled.

Example. MUDDY 750, GO AROUND.

m. Pathfinder informing an aircraft that it should continue its approach to the landing area.

Example. MUDDY 750, CONTINUE APPROACH.

n. To inform an aircraft of an observed aircraft condition when requested or when you deem necessary.

Example. MUDDY 750, LANDING GEAR APPEARS DOWN AND IN PLACE.

o. To describe vehicles, equipment, or personnel on the movement area in a manner which will assist pilots in recognizing them.

Example. MUDDY 750, AIRCRAFT TO LEFT OF RUNWAY.

MUDDY 750, VEHICLES ON TAXIWAY.

p. Describe military traffic by either of the following as appropriate:

(1) Service and type.

Example: ARMY HELICOPTER ON DEPARTURE END.

(2) To pilots familiar with military designations as a group figure rather than individual fires.

Example. MUDDY 750, BE ADVISED CH-47 ON RIGHT SIDE OF RUNWAY.

q. Describe the relative positions of traffic in an easy-to-understand manner, such as TO YOUR RIGHT or AHEAD OF YOU, instead of local terminology or compass directions.

Example: MUDDY 750, U-6 ON DOWNWIND TO YOUR LEFT.

5. Air Traffic Communication Words and Phrases

The following is a list of air traffic words and phrases and their meanings.

Abort—A failure to complete a landing or takeoff for any reason.

Acknowledge—Let me know that you have received and understand the message.

Affirmative—Yes.

Approved—When a pilot's request for a certain clearance can be met.

Be Advised—I am informing you of an unusual condition or hazard to flight.

Break—(1) To indicate the separation between back-to-back transmissions to two separate aircraft.

(2) To indicate the separation of the text from other portions of the message.

Correction—An error has been made in this transmission; the correct version is —.

Do Not Land—Self-explanatory.

Execute—Commence dropping personnel or equipment.

Go Ahead—Proceed with your message. Normally used when answering a call-up.

Go Around—Do not land; terminate your approach for landing; circle the landing area and begin another approach.

How Do You Hear Me?—Self-explanatory.

I Say Again—Self-explanatory.

Mayday—An emergency is in effect, clear the airways.

Negative—That is not correct.

No Drop—Cease dropping or do not drop personnel or equipment.

Out—This transmission is ended and no response is expected.

Over—My transmission is ended and I expect response from you.

Read Back—Repeat all this message back to me.

Report—Instruction to an aircraft to contact the control facility when reading a designated location, such as, REPORT ONE MILE FINAL.

Roger—I have received and understood all of your last transmission.

Say Again—Self-explanatory.

Say I.D.—Identify yourself.

Speak Louder—Self-explanatory.

Standby—(1) Must pause for a few seconds.

(2) Prepare to drop personnel or equipment.

That Is Correct—Self-explanatory.

Unable To Approve—When a pilot's request for a certain clearance cannot be met.

Unknown Station—The identity of the station with whom I am attempting to establish communication is unknown.

Use Caution—Self-explanatory.

Verify—Check with the originator.

Words Twice—Communication is difficult; transmit each phrase twice. This proword may be used as an order, request, or as information.

What Are Your Intentions?—Self-explanatory.

What Is Your Location?—Self-explanatory (normally requested by an air traffic controller to determine exact aircraft location).

Wilco—Will comply.

You Are Unreadable (Broken, Garbled)—Your radio transmission cannot be understood.

6. Traffic Pattern

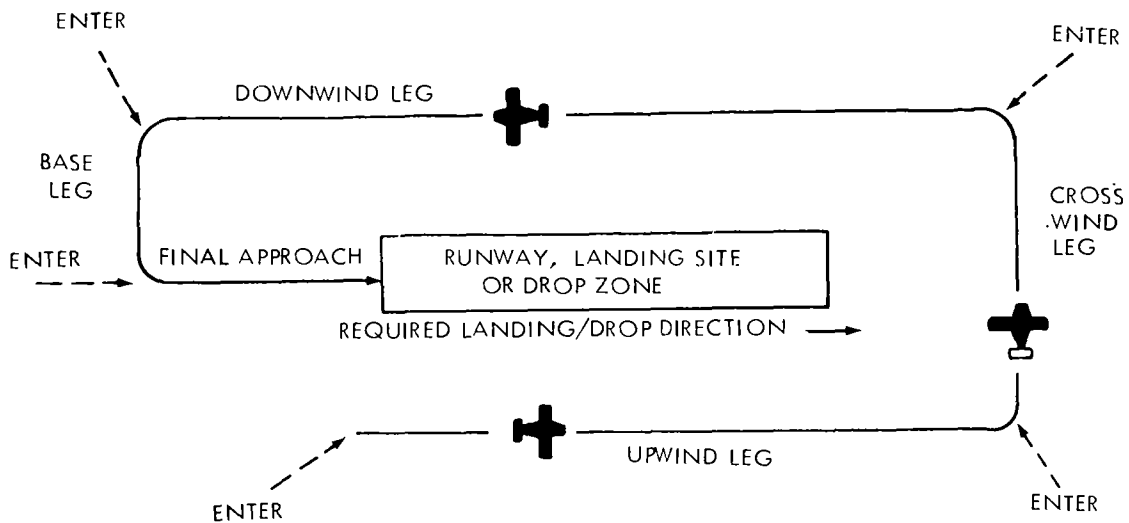
a. A traffic pattern (fig. 17) is used to maintain control in and around a landing site, airfield, or drop zone.

(1) *Left-hand traffic pattern.* The aircraft makes all left turns, keeping airfield, landing site, or drop zone to the pilot's left. This is the normal traffic pattern.

(2) *Right-hand traffic pattern.* The aircraft makes all right turns, keeping airfield, landing site, or drop zone to the pilot's right.

b. An aircraft may enter the traffic pattern from any point and from any direction within the area surrounding the landing strip and/or site, consistent with safety requirements.

LEFT-HAND TRAFFIC PATTERN (STANDARD)



- NOTES: a) TRAFFIC PATTERN ALTITUDE IS NORMALLY 1000-1200 FT ACTUAL
 b) TRAFFIC PATTERN MAY EXTEND OUT TO ONE MILE IN ALL DIRECTIONS FROM THE RUNWAY, LANDING SITE, OR DROP ZONE.

RIGHT-HAND TRAFFIC PATTERN

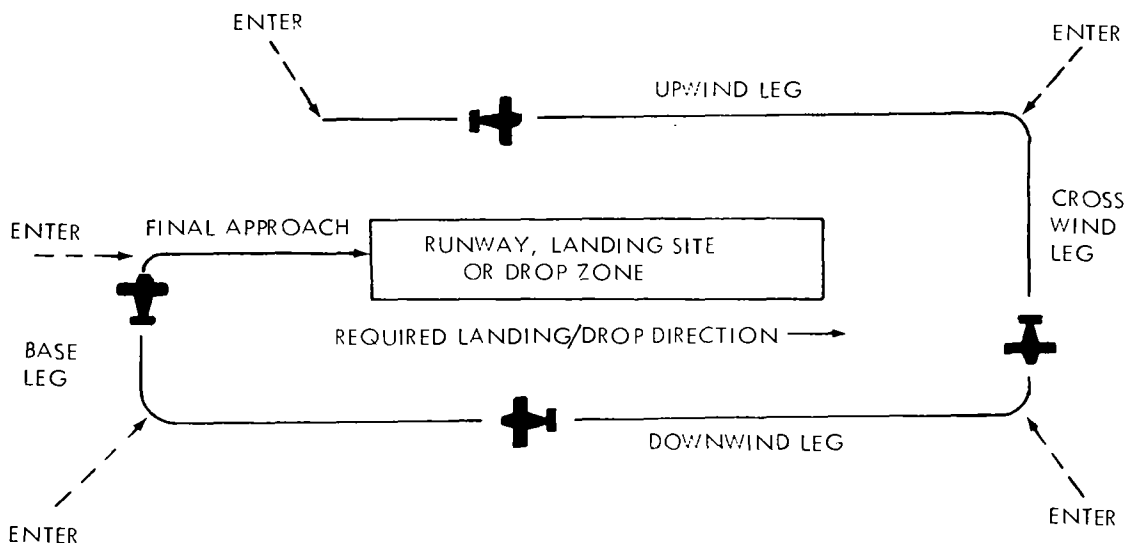


Figure 17. Air traffic patterns.

c. A straight-in approach is on a line within 20° of the center line of the landing strip.

d. A traffic pattern normally extends out to 1 mile from the center line of the landing area

in all directions, depending on the type of aircraft or size of the facility.

e. The altitude flown while in the traffic pattern is normally between 1000 and 1200 feet.

f. There are five legs to a traffic pattern:

(1) *Upwind leg.* A flight course parallel to the landing runway in the direction of landing.

(2) *Crosswind leg.* A flight course at right angles to the landing runway off its upwind leg.

(3) *Downwind leg.* A flight course parallel to the landing runway in the direction opposite to landing.

(4) *Base leg.* A flight course at right angles to the landing runway off its approach and extending from the downwind leg to the intersection of the runway center line extended.

(5) *Final approach.* A flight course in the direction of landing along the runway center line, extending from the base leg down to the runway.

7. Field Condition Information

As a pathfinder air traffic controlled, you must issue pertinent field condition information necessary for an aircraft's safe operation in time for it to be useful to the pilot. Include the following information, as appropriate:

a. Construction work on or immediately adjacent to the movement area.

b. Rough portions of the movement area.

c. Braking conditions caused by ice, snow, mud, slush, or water on the runway.

d. Parked aircraft on the movement area.

e. Any other pertinent field operations, situations, or conditions.

8. Advisory Service

Locations and configurations of airfields and landing sites vary greatly. It is safe to say that no two areas and situations encountered will be identical. A different location presents problems of its own with respect to environmental conditions, peculiar weather characteristics, a preferential landing direction, and other considerations. The following are some typical examples:

a. The final approach to a particular runway may require a glide slope angle that is higher than normal.

b. Unusual terrain features near the airfield may, under certain wind conditions, create turbulence that can be hazardous to aircraft operating nearby. Additionally, helicopters operating on or adjacent to the airfield can

create turbulence which may be hazardous to light aircraft.

c. Turns immediately after takeoff from some runways may be required due to prohibited areas, mountains, or other obstacles directly in line with the end of the runway.

d. Known friendly artillery or mortar fire within the control zone will require that the pathfinder give the aviator information pertaining to the origin, range, direction, and maximum ordinate of the firing. Air strikes within the control zone, especially those involving high performance aircraft, must be included.

e. Information pertaining to enemy situation must be given to the aircraft.

9. Taxiing Aircraft

a. When issuing taxi information, include the route for the aircraft to follow on the movement area, plus instructions to hold at a specific point, if necessary. However, movement of aircraft within loading, maintenance, dispersal, or parking areas is the responsibility of the pilot, although he might be assisted by signalmen. Issue concise and easy to understand taxi information.

Example. MUDDY 750, TURN RIGHT
AT SIGNALMAN.

SERPENT 412, TURN LEFT
AT END OF RUNWAY.

b. Hold a taxiing aircraft short of an active runway at least two airplane lengths, to insure that landing aircraft have sufficient clearance.

10. Visual Signal Procedures and Techniques

a. A rapid and efficient means of communications between aircraft and ground stations is a necessity in air traffic control. Two-way radio is the most advantageous system since information can be exchanged quickly and there is little doubt as to the intent of the messages. Since all aircraft may not be equipped with operative radios, however, a system of visual signals has been established. Colored smoke signals may also be used, but prior coordination must be made between the pathfinder and the aviation unit. The visual system also serves as a standby or back-up means of communications in case of radio failure in the aircraft or control center, or if an aircraft desires to land and does not have the control frequency.

b. Standard light signals are as follows:

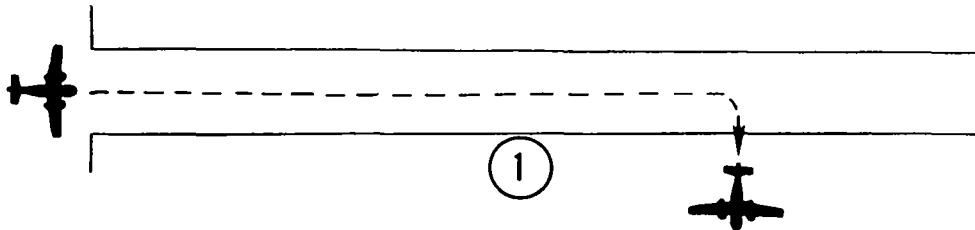
<i>Color & Type of Signal</i>	<i>Meaning on the Ground</i>	<i>Meaning in Flight</i>
Steady green	Cleared for takeoff	Clear to land.
Flashing green	Clear to taxi	Return for landing (to be followed by steady green at the proper time).
Steady red	Stop	Give way to other aircraft and continue to circle.
Flashing red	Taxi clear of landing area and/or runway in use.	Airfield unsafe—Do not land.
Flashing white	Return to starting point on the airfield.	
Alternating red and green	GENERAL WARNING SYSTEM—EXERCISE EXTREME CAUTION.	

11. Minimum Separation Requirements

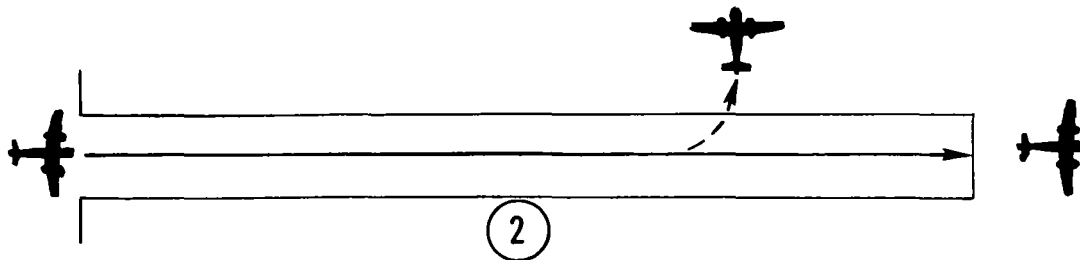
The minimum separation criteria illustrated in figure 18 should be followed during normal

operations. Combat situations, however, may often dictate less separation.

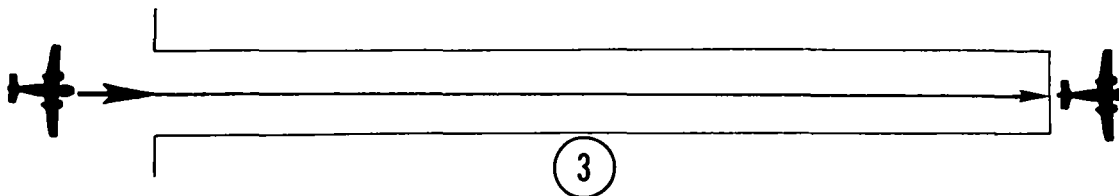
ARRIVING AIRCRAFT. THE PRECEDING AIRCRAFT HAS TAXIED OFF THE LANDING STRIP BEFORE THE SUCCEEDING AIRCRAFT CROSSES THE APPROACH END THEREOF ON ITS FINAL GLIDE:



DEPARTING AIRCRAFT. THE PRECEDING AIRCRAFT HAS EITHER CROSSED THE OPPOSITE END OF THE RUNWAY OR TURNED AWAY FROM THE PROJECTED PATH OF THE SUCCEEDING AIRCRAFT BEFORE THE LATTER BEGINS ITS TAKE-OFF RUN.



ARRIVING AIRCRAFT AND A PRECEDING DEPARTING AIRCRAFT. THE PRECEDING DEPARTING AIRCRAFT HAS CROSSED THE OPPOSITE END OF THE RUNWAY BEFORE THE ARRIVING AIRCRAFT CROSSES THE APPROACH END THEREOF ON ITS FINAL GLIDE.



DEPARTING AIRCRAFT AND A PRECEDING ARRIVING AIRCRAFT. THE PRECEDING ARRIVING AIRCRAFT HAS TAXIED OFF THE RUNWAY BEFORE THE DEPARTING AIRCRAFT BEGINS TAKE-OFF RUN.

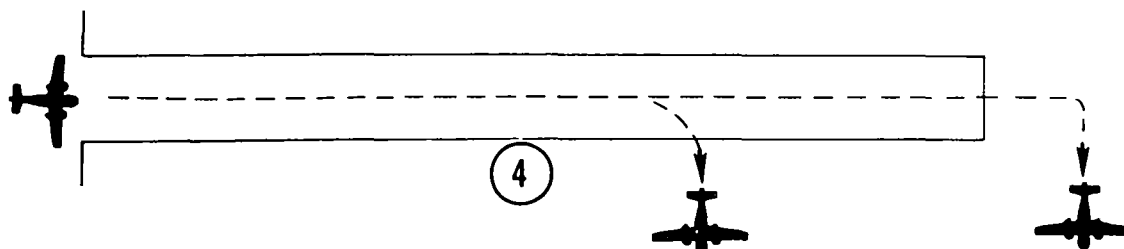


Figure 18. Minimum separation requirements.

APPENDIX F

STANDARD HAND-AND-ARM SIGNALS

1. General

The standard hand-and-arm signals contained in this appendix may be used effectively to assist in landing, hovering or taxiing, and parking of aircraft (figs. 19-37).

2. Conduct of Signaling

a. Signal must be given in a clear, distinct manner so as not to be confused with other similar signals. Signals should be given only when needed.

b. Signals at night are given using lighted batons or flashlights in each hand. Signals given at night are identical to the day signals. When using flashlights, as an expedient, care must be taken to preclude blinding the pilot. Batons and flashlights should remain lighted at *ALL TIMES* when signaling.

c. Speed of arm movement indicates desired speed of aircraft compliance with signal.



Figure 19. Signalman's position (helicopter). The position for the signalman when directing a helicopter is to the right front of the aircraft, where he can best be seen by the pilot. When directing armed helicopters, the signalman should not position himself directly in front of the aircraft at any time.



Figure 20. Assume guidance. Arms above the head in vertical position with palms facing inward.



Figure 21. Proceed to next signalman. Right or left arm down, other arm moved across the body and extended to indicate direction to next signalman.

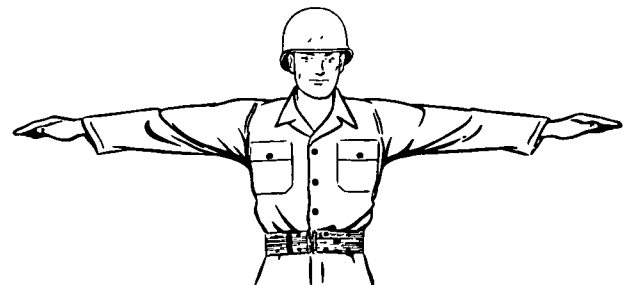


Figure 22. Hover. Arms extended horizontally sideways palms downward.

Note. When guiding a landing helicopter, this signal normally should not be given until the helicopter is approximately 5 feet off the ground and just short of the desired landing point, depending on its forward speed.



Figure 23. Move ahead. Arms a little aside, palms facing backwards and repeatedly moved upwards and backwards from shoulder height.

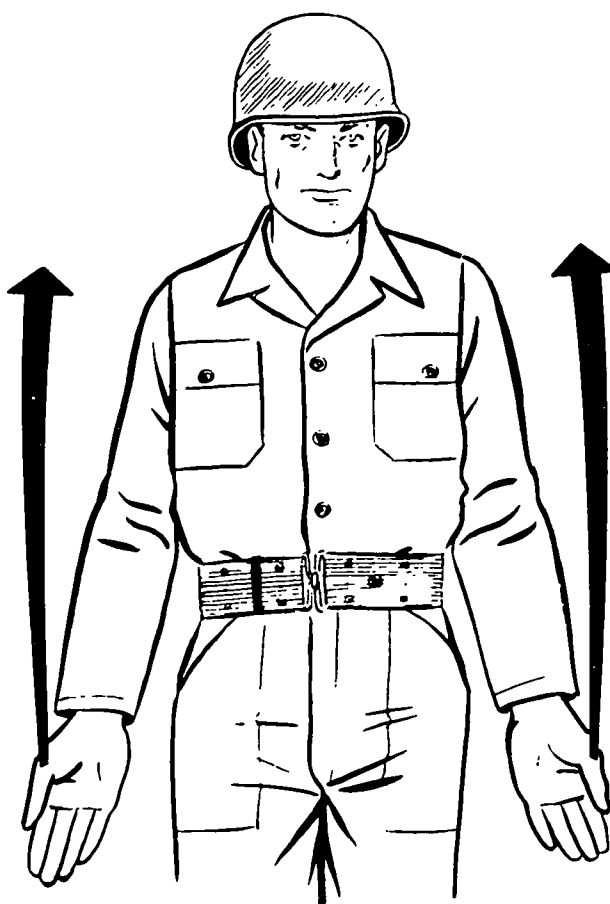


Figure 24. Move back. Arms by sides, palms facing forward, arms swept forward and upward repeatedly to shoulder height.

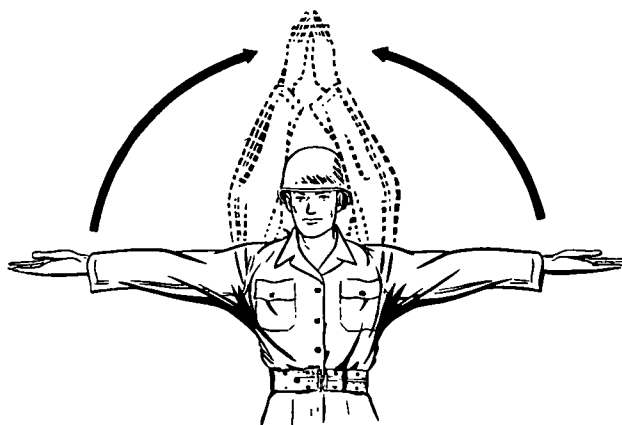


Figure 25. Move upwards. Arms extended horizontally sideways beckoning upwards, with palms turned up.

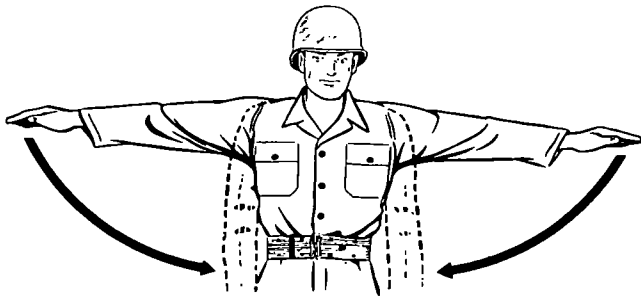


Figure 26. Move downwards. Arms extended horizontally sideways beckoning downward, with palms turned down.



Figure 27. Cut sling load. Left arm is extended sideways in direction of movement and other arm swung in front of body in same direction, in repeating movement.

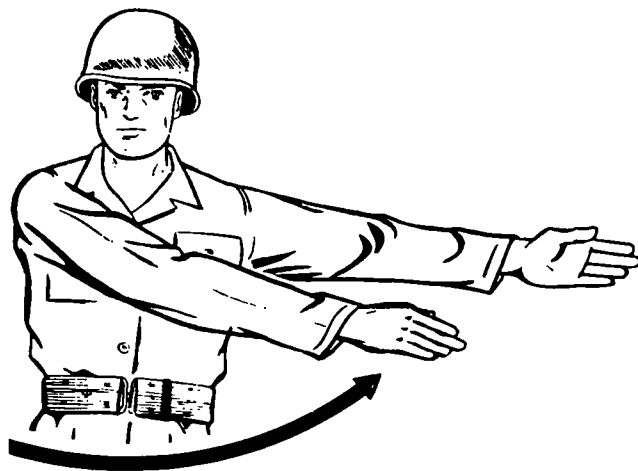


Figure 28. Move right. Left arm extended horizontally sideways in direction of movement and other arm swung in front of body in same direction, in repeating movement.



Figure 29. Spot turn. Left or right hand moving upward and backward, from a horizontal position, to indicate direction of tail movement. Other hand pointing to center of spot turn. Signalman must remain in full view of the pilot.

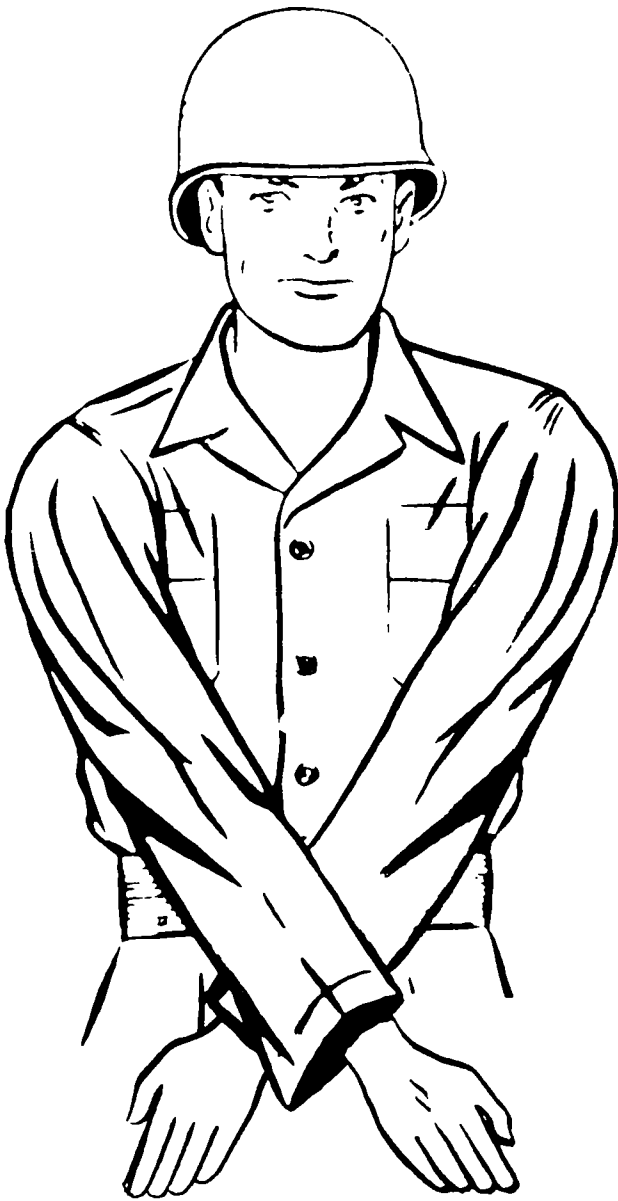


Figure 30. Land. Arms crossed and extended downward in front of the body.

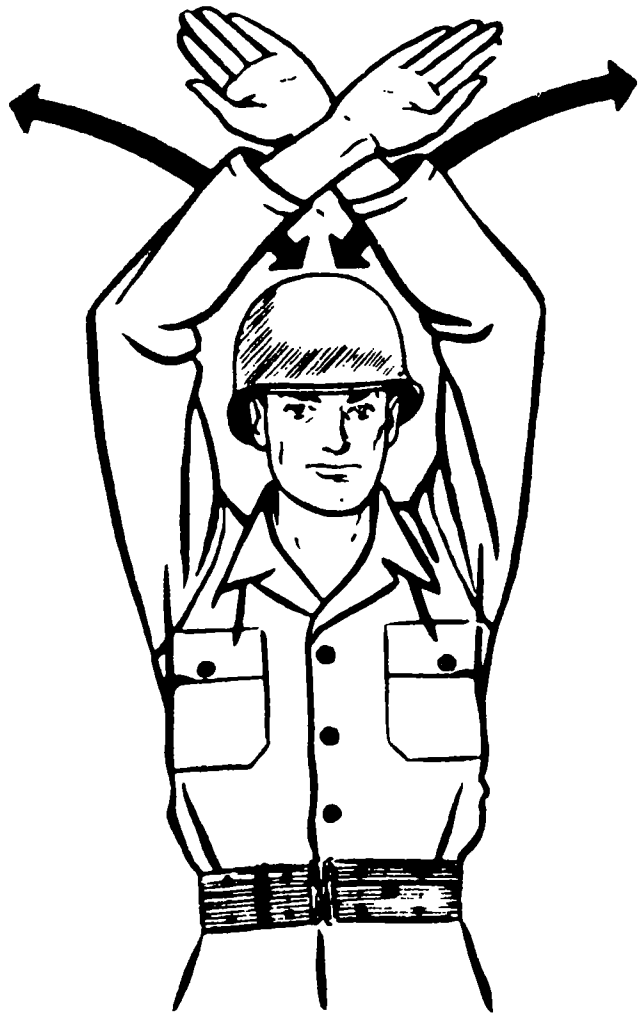


Figure 31. Stop. Arms repeatedly crossed above the head. (May be used to indicate "go around.")

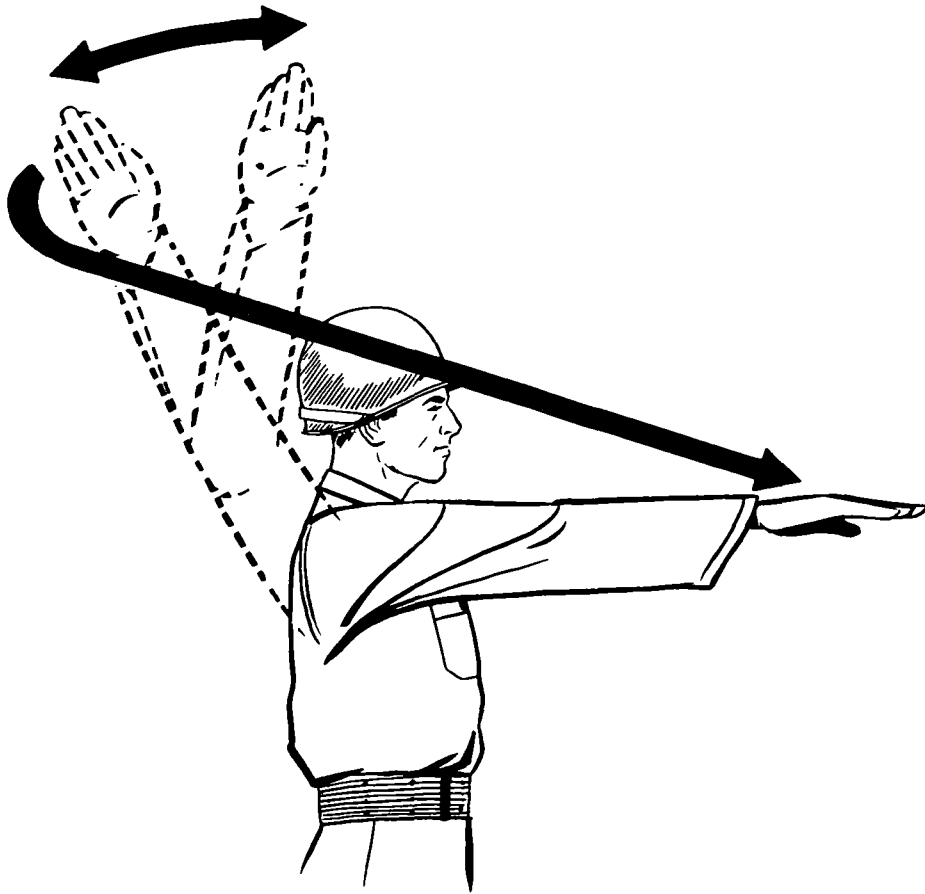
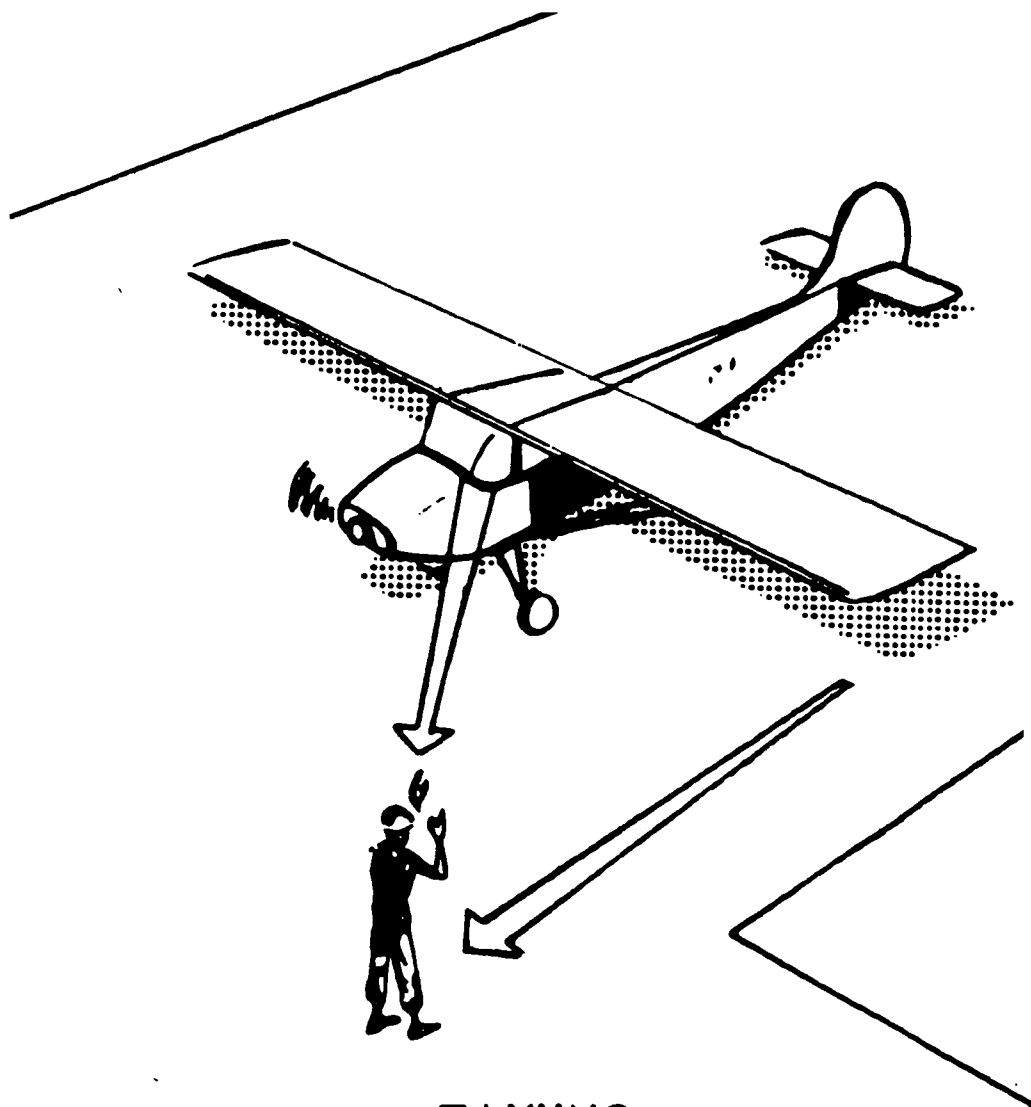


Figure 32. Takeoff. Make circular motion with right hand overhead, ending in a throwing motion in the direction of takeoff.



TAXIING

Figure 33. Signalman's position (airplanes). The position for the signalman when directing airplanes is forward of the left wingtip in full view of the pilot.

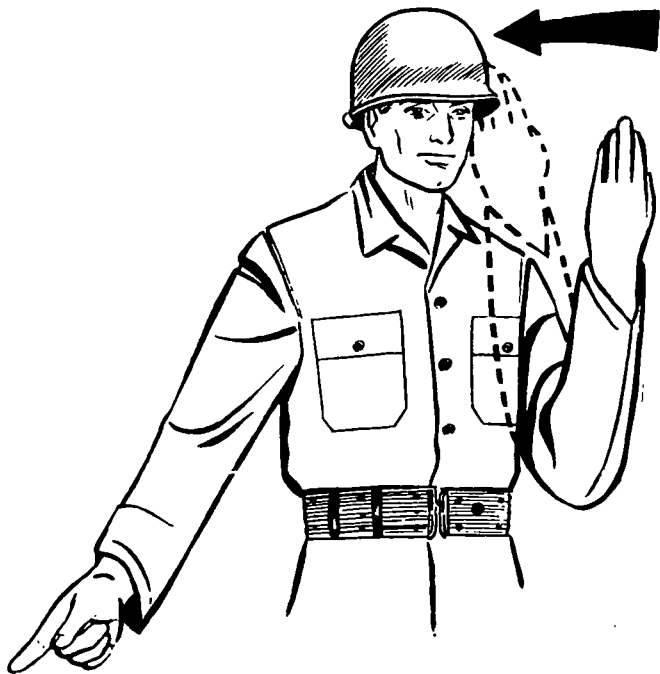


Figure 34. Turn left. Point right arm downward and point to left wheel, left arm repeatedly moved upward-backward.



Figure 35. Turn right. Point left arm downward and point to right wheel, right arm repeatedly moved upward-backward.

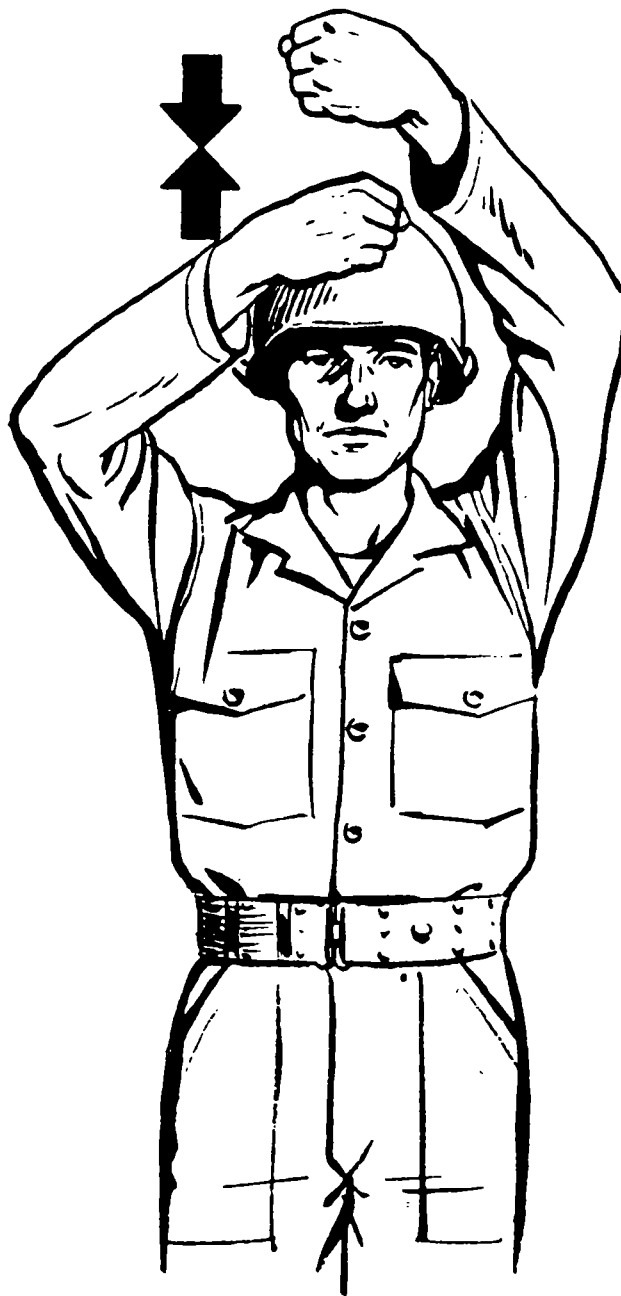


Figure 36. Hook up complete (slingload). Place right fist in front of head and left fist over right fist in a rope climbing position. Then bump fist together.



Figure 37. Cut sling load. Left arm is extended horizontally with the fist toward the load while the right arm makes a horizontal slicing motion under the left arm, palm down.

GLOSSARY

Advisory Service—Advice and information provided by a facility to assist pilots in the safe conduct of flight and aircraft movement.

Aerial Fire Support—A capability of Army aviation to provide the ground force commander with offensive and defensive fires for the destruction or neutralization of enemy targets.

Aerial Fire Request—A request for any aerial fire support means to provide offensive or defensive fires for the destruction or neutralization of enemy targets.

Aerial Rocket Artillery—Army helicopters configured with an air-to-ground rocket delivery system, used for area fire, and organic to an artillery battalion.

Aerial Surveillance—The observation of specific air or surface areas by visual, electronic, photographic, or other means to provide timely intelligence information for supported tactical ground commanders.

Aerial Control Point (ACP)—An easily identifiable topographic feature of the terrain or an electronic navigational aid along a flight route to control an airborne formation to and from the objective area.

Air Traffic—Aircraft operation in the air or on an airport surface, exclusive of loading ramps and parking areas.

Air Traffic Control (ATC)—Air traffic control is an agency that provides services to promote the safe and expeditious flow of air traffic.

Airmobile Combat Assault (CA)—(combat assault helicopter assault force). Tactical organization combining helicopter and supported ground units, to conduct combat operations into an unsecure LZ.

Airmobile Force (AMF)—(airmobile units) The aviation and ground combat elements combined to conduct airmobile operations.

Airmobile operations—Operations in which forces and their equipment move about the

battlefield in air vehicles, under the control of the ground force commander to engage in ground combat.

Air Movement Plan—Used in detailed planning for an airlift, when the airlift of troops is involved. It is prepared jointly by the respective ground force and aviation unit commanders.

Airport—An area of land or water that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.

Airport Traffic Area—Unless otherwise specifically designated, that air space within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control facility is operating, extending from the surface up to, but not including, 2,000 feet above the surface.

Allowable Cargo Load (ACL)—The number of troops, amount of cargo, or combination determined by weight, cubic displacement, and distance to be flown, which may be transported by one aircraft in one sortie.

Alternate Landing Site—A site selected to support a ground tactical plan and used if enemy action, unfavorable terrain, or change in situation require a change from primary landing site.

Altimeter Setting—A barometric pressure in inches (of mercury) for setting a pressure scale type of altimeter. For example, a barometric pressure of 29.92 inches of mercury would be stated as "altimeter two niner niner two."

Assault Echelon—The lead elements of an airmobile force scheduled for initial assault of the objective area.

Assault Force—Those units charged with the seizure of the objective area.

Basic Planning Guide—Report prepared by ground units, showing echelonment of personnel and equipment of the units to serve

as a basis for determining the aircraft needs for an operation.

CDS—Container delivery system (USAF).

Ceiling—For practical purposes, the lowest height above the surface at which the total cloudiness between that level and the surface (as seen by a ground observer) covers more than half the sky.

Center of Gravity (CG)—The point about which an object would balance if supported at that point, or the point at which the weight of an object or group of objects may be considered concentrated.

Chalk Number—A single aircraft or aircraft load within a flight element.

Clearance—An authorization by an air traffic controller, for the purpose of preventing collisions between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled air space.

Closed Traffic—Air traffic that remains within the traffic pattern around a landing site.

Combat Loading (Cross Loading)—The loading of personnel to maintain tactical integrity consistent with type aircraft; and the storage of equipment and supplies to permit direct employment into the area of operations.

Command and Control Aircraft (C AND C A/C)—An aircraft, usually a UH-1D, equipped with additional FM and UHF radios and used by the airmobile force commander and his staff in controlling airmobile operations.

Communication Checkpoint (CCP)—An easily identifiable topographic feature on the terrain along a flight route over which aircraft inbound to a landing and/or drop zone initiate radio contact with a control facility at the landing and/or drop zone.

Contour Flying—Low altitude flight in which the flight pattern conforms generally to the contours of the ground. It is used to avoid observation or detection of an aircraft and/or the prints to and from which it is flying.

Control Center—A location from which appointed personnel control air traffic in and around a landing drop zone to promote safe, orderly, and expeditious air movement.

Control Zone—Control zones extend upward from the surface. A control zone may include one or more landing and/or drop zones

and is normally a circular area of 5 statute miles in radius with extensions where necessary to include instrument approach and departure paths.

Controlled Airspace—Airspace designated as continental control area, control zone, or transition area, within which some or all aircraft may be subject to air traffic control.

Course—The intended direction of horizontal flight.

Density Altitude (DA)—Density altitude is determined by altitude, temperature and humidity. Generally speaking, high, hot, and dry conditions (high density altitude) will decrease the lift capability of an aircraft.

Drop Altitude—Actual altitude in feet of an aircraft above the ground at the time of the initiation of an airdrop.

Drop Zone (DZ)—A specified area upon which airborne troops, equipment and supplies are dropped by parachute, or on which supplies and equipment may be delivered by free fall.

Eagle Flight—An airmobile force either on ground or air alert to perform rapid reaction mission.

Extraction—Voluntary or involuntary withdrawal by air of troops, equipment, or supplies from an area.

Final Approach (VFR)—A flight path of a landing aircraft in the direction of landing along the extended runway centerline from the base leg to the runway.

Flight—Two or more Army aircraft, with a common mission, under the control of a single flight leader.

Flight Leader—An aviator who commands a designated flight of aircraft on a common mission supporting one unit.

FM Home—A directional homing or beacon signal given by keying an FM radio.

Glide Slope—The vertical slope between an aircraft and the landing surface during an approach. The glide slope is normally expressed in degrees.

Glide Slope Indicator (GSI)—A device designed to emit a visual, three-color light beam which indicates to an aviator a safe glide path for an aircraft over approach obstacles into a landing site.

Ground Controlled Approach (GCA)—Landing, usually under IFR conditions, accom-

- plished with the assistance of a ground controller using radio and radar to direct an aircraft to, and maintain it on, the correct course and glide path to accomplish a successful landing.
- Ground-to-Air Radio**—A radio used to maintain communication with aircraft.
- Heliport**—An area prepared for the accommodation, landing and takeoff of helicopters only.
- H-HOUR**—Pertaining to airmobile and/or airborne operation, H-Hour is the time of touchdown of the lead ship of an assault echelon in the landing zone, or the initiation of the drop of the first load of parachutists.
- Homing Beacon**—A device transmitting an electronic signal used to assist in the guidance of aircraft.
- IFR Conditions**—Weather conditions below the minimums prescribed for flights under visual flight rules.
- Internal Net Radio**—A radio used to maintain communication with other elements of a pathfinder unit at the same or adjacent locations.
- Instrument Flight Rules (IFR)**—Rules prescribed by the Civil Air Regulations governing instrument flight.
- Knots**—A unit of speed equivalent to 1 nautical mile or 6,080.2 feet per hour. Sixty nautical miles equals 1° of a terrestrial great circle.
- Landing Aids**—Any system or device for aiding aircraft in an approach for landing.
- Landing Formation**—The formation in which aircraft will land. It is desirable to land aircraft in the same formation in which they are flying.
- Landing Point**—A designated or selected touchdown point where a single aircraft lands.
- Landing Site**—A subdivision of a landing zone that contains one or more landing points.
- Landing Strip**—An airfield which may include a runway, taxiways, parking points, and dispersal areas. The three classifications of airfields are pioneer, hasty, and deliberate, depending upon the degree of improvement.
- Landing Zone**—A landing area that encompasses one or more landing sites and/or strips, and normally has the required control facilities.
- Lapes**—Low altitude parachute extraction system (USAF).
- Lift**—A tactical grouping of one or more serials of aircraft operating on an assigned mission.
- Light Gun**—A long, range, highly directional, visual signaling device normally used in a ground-to-air role.
- Local Traffic**—Aircraft operating in the traffic pattern of the landing area concerned.
- Lolox**—Low level extraction (U.S. Army).
- Medical Evacuation (MEDEVAC)**—The primary mission of air ambulance units and a secondary mission of all Army aircraft.
- Minimum Safety Altitude**—The altitude below which it is hazardous to fly.
- Movement Area**—The part of the airfield reserved for taking off, landing, and taxiing of aircraft.
- Pathfinder (PFDR)**—Trained individuals who provide navigational assistance to and control of aircraft.
- Pickup Zone (PZ)**—The designation of a tactical extraction area secured by the extracted force with diminishing security after each lift.
- Pre-Strike**—Air Force, artillery, or armed helicopter fire placed on an LZ and/or objective area prior to the arrival of the airmobile task force.
- Release Point (RP)**—An established traffic control point and final navigational checkpoint along a flight route for aircraft approaching the landing and/or drop zone.
- Reporting Point**—A geographical location in relation to which the position of an aircraft is reported.
- Runway End**—The end of that portion of the runway usable for landing or takeoff.
- Search and Rescue Facility**—A facility responsible for maintaining and operating a search and rescue service for occupants of missing or downed aircraft.
- Separation**—Spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off; a specified longitudinal, vertical, or lateral distance between two or more aircraft in flight provided by air traffic control to insure safety in the air.
- Serial**—A tactical grouping of two or more flights, under control of a single mission

commander separated from other tactical grouping of flights.

Sortie—One aircraft making one takeoff and one landing.

Staging Area—A geographic locality between the base camp and the objective of an airborne force through which the parts thereof pass for refueling, regrouping, inspection and redistribution of troops, to continue operations more efficiently. Encompasses as a rule, a forward logistical base, aviation fueling-arming facilities, and the AMF reserve.

Station Time—That time when all personnel and/or material must be loaded and prepared for takeoff.

Straight-In Approach (VFR)—Entry of the traffic pattern by interception of the extended runway centerline without executing any other portion of the traffic pattern.

Supporting Aircraft—Supporting aircraft consist of all aircraft designated to provide combat support, combat service support, or command and control service to a land force.

Suppressive Fires—Fires placed upon known or suspected locations of enemy troops, weapons, or likely enemy positions which, because of their proximity to the flight path, present an immediate or potential threat to aircraft movement. Suppressive fires are employed during helicopter assault of an enemy position in order to greatly reduce effective enemy small arms and automatic weapon fires directed against the assault landings. Fires are provided by Army air-

craft armed for the expressed mission of aerial fire support.

Takeoff Clearance—Authorization by an air traffic control tower for an aircraft to take-off.

Terminal Guidance Personnel—Selected personnel other than qualified pathfinders within a ground unit who are trained to provide minimum guidance, information, and control to aircraft in the absence of TOE pathfinder elements.

Traffic Pattern—The traffic flow that is prescribed for aircraft landing at, taxiing on, and taking off from an airport. The usual components of a traffic pattern are upwind leg, crosswind leg, downwind leg, base leg and final approach. A traffic pattern may also be used around a drop zone.

UHF Communications—Communications using the ultra-high radio frequencies. Frequency span is 300 megacycles to 3000 megacycles.

Vector—A heading issued to an aircraft to provide navigational guidance by radar.

Visual Flight Rules (VFR)—Rules prescribed by the Civil Air Regulations governing visual flight.

VFR Conditions—Weather conditions equal to or better than the minimums prescribed for flights under Visual Flight Rules.

VFR Flights—Flights governed by Visual Flight Rules.

VHF Communications—Communications using the very high radio frequencies. Frequency span is 30 megacycles to 300 megacycles.



By Order of the Secretary of the Army:

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